SUMMER / FALL 2021

THE POLAR TIMES

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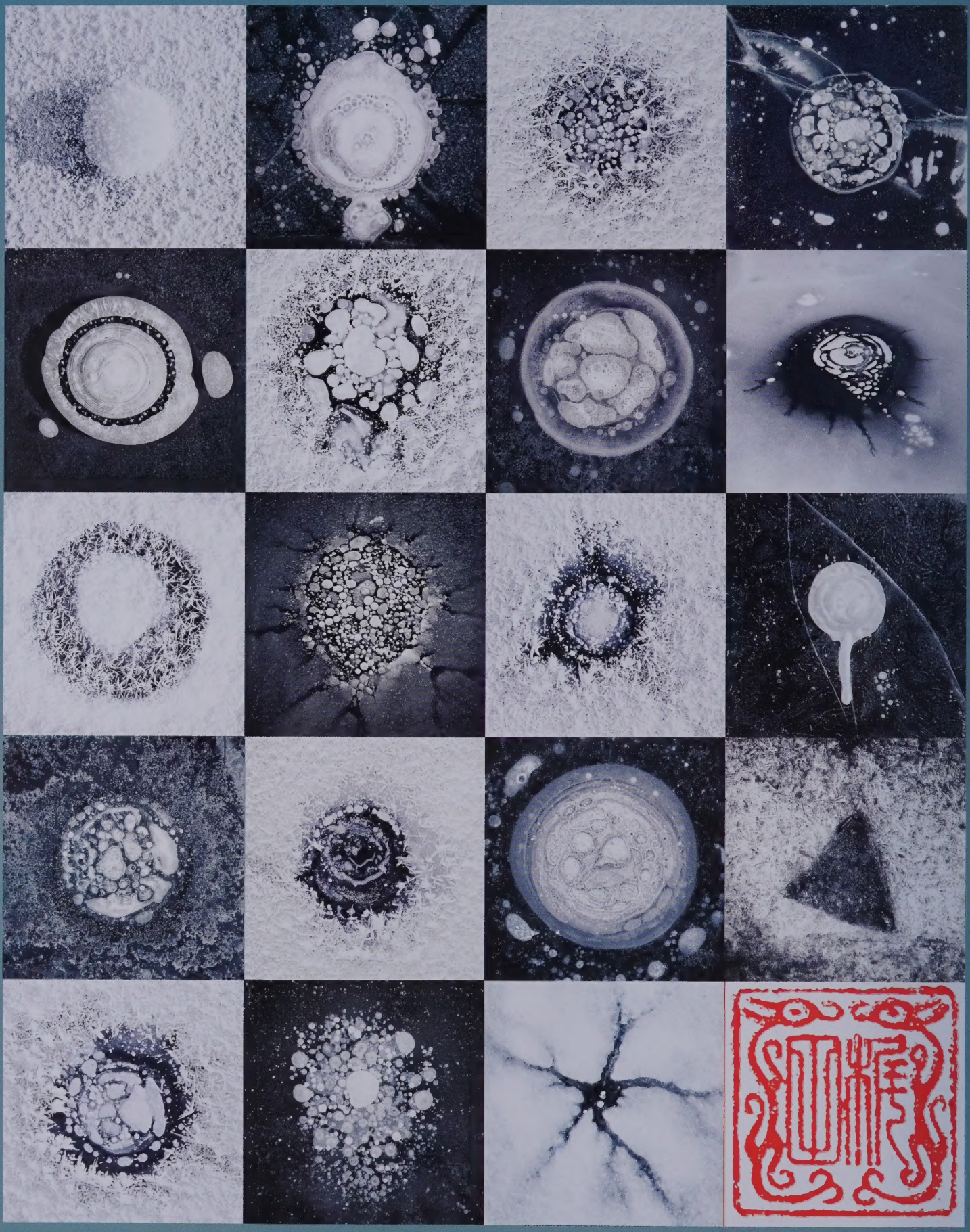
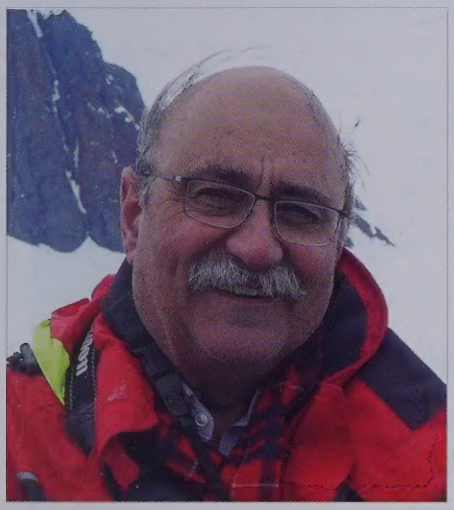
VOLUME 4, NUMBER 4 | WWW.AMERICANPOLAR.ORG



Ice Formations • by Ryota Kajita, photographer

President's Message

TO INCREASE AND DIFFUSE KNOWLEDGE OF THE POLAR REGIONS, TO INSPIRE PEOPLE TO CARE ABOUT THE ARCTIC AND ANTARCTIC. TO PROTECT THE POLAR UNKNOWN.



DEAR FELLOW AMERICAN POLAR SOCIETY MEMBERS:

It's good to know there is growing attention on matters in the Arctic and Antarctic, even if it's for potentially alarming reasons as the planet continues to warm. I am hopeful that we will see increased awareness on climate issues... and that the pandemic threat will diminish in 2022, so that we may begin to think about a general meeting for our American Polar Society membership. As always, I welcome your thoughts in that regard. On the diplomatic front, we find the usual ups and downs of affairs in the polar regions. In the South, more countries are showing interest in that tiny crustacean – krill. Some fishing nations have been blocking the finalization of the krill management plan, which raises concerns of localized over-harvesting. Krill, which make up a large portion of feed for the seafood we consume, are a major resource for fish farms. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) held a meeting in October to set catch limits. Though consensus was reached to extend a krill fishing regulation, the fishing versus non-fishing nations divide was evident as progress on committing to future Maritime Protected Areas stalled for the fifth consecutive year.

The U.S. is co-sponsoring two more proposals under the Antarctic Treaty to create Marine Protected Areas in the Weddell Sea and East Antarctica, and we continue to support all three MPA proposals (including Argentina/Chile's call for the third). Parties also reaffirmed their commitment to maintain the ban on any future mining, as agreed to under the Environment Protocol of 1991, which bans any mining until 2038.

Antarctic tourism rebounded slightly this year, although numbers are still well below normal. And, for the record, it should be noted that in August, the U.S. Fish and Wildlife Service proposed listing the emperor penguin as a threatened species under the U.S. Endangered Species Act of 1973.

In the North, at the last Arctic Council Ministerial meeting, the Council began to investigate the creation of a joint scientific expedition to the Arctic of all Arctic States. These expeditions are normally supported by two or more countries, rather than all eight Arctic parties. At the same meeting, Russia assumed the Chairmanship of the Arctic Council for the next two years until 2023, as is the normal rotation. Two new positions were created: an Indigenous Envoy and a Youth Envoy. By its charter, the Arctic Council abstains from both military matters and fishery issues, focusing instead on cooperation in science, environmental protection and sustainable development. It will be interesting to observe Russia's plans during its leadership.

The United States-Greenland Joint Commission met in September for the first time since 2014. The icebreaker USCGC *Healy*, which transited the Northwest Passage, was in Nuuk during the meeting. For more information about the meeting, see: www.arctictoday.com/us-coast-guard-science-joint-mission-northwest-passage/.

Additionally, the Central Arctic Ocean Fisheries Agreement entered into force earlier this summer, an encouraging sign of Arctic cooperation. For more info, see: www.state.gov/the-agreement-to-prevent-unregulated-high-seas-fisheries-in-the-central-arctic-ocean-enters-into-force/.

In closing, with a bit of sadness, I wish to note that both our Editor, Moki Kokoris, and our Art Director, Mary McBride, have decided to step down from their *Polar Times* positions. They are off to new endeavors, and we wish them well! Many thanks for this splendid issue... and for all their efforts over the years!

As always, please enjoy this issue, and let us know your thoughts for the future.

All the best,

Ray

Ray Arnaudo is a retired diplomat and former Senior Scholar at the American Association for the Advancement of Science, with a career of experience in international environmental and science policy affairs at the State Department. He is currently a member of the National Science Foundation's Polar Affairs Advisory Committee.

(A tip o' the pen to Bill Muntean and Lou Crishock of the Office of Oceans and Polar Affairs at the State Department for their helpful reporting).

Cover: Front view of "Man Holding Bird," by John Kurok, Leo Napayok

Letter from the Editor

DEAR KITH:

My objective in compiling material for articles for *The Polar Times* has been to expand the content so that it appeals to a broader demographic, namely multiple sectors of society, professions, and interests. We've published pieces about polar research expeditions, history, new technology and discoveries, human interest stories, documentary films, governance, a few entertaining tidbits for the younger crowd, and stories focusing on art with a polar twist. Essential to my vision has been the inclusion of the Arctic Indigenous perspective.

In this issue, we proudly feature Matchbox Gallery and the Kangirqliniq Center for Arts and Learning in Nunavut. Not only is it the only privately-owned, artist-run, cross-cultural gallery/workshop of its kind in Canada, but the gallery has also succeeded in preserving the reputation of Rankin Inlet as the only community that produces Inuit fine-arts ceramics in the world.

Our lead story, the documentary film *After Antarctica*, honors the long legacy of world-renowned polar luminary and APS Governor Emeritus, Will Steger, who is also a personal friend. The movie is still running the film festival circuit, but should soon be available for screening. Thank you, Will, for your steadfast dedication to the preservation of both the Arctic and Antarctic.

The remainder of the articles herein should speak for themselves, Lawson Brigham's "Reflections on U.S. Polar Security Cutters for the 21st Century" piece being of particular relevance in the landscape of current affairs. I trust you'll also find the 'Amusing Musings' and 'Bergie Bits' entries compelling, illuminating and engaging.

As you've learned through our APS President's message, as of the publication of the issue you hold in your hands, I will be handing over my proverbial quill to a new editor once s/he is found. The APS will also be seeking to fill the position of Art Director, heretofore held by Mary McBride.

It has been my distinct pleasure and privilege to serve the APS in this capacity. Your letters of support and praise have buoyed me through the challenges all of us faced during the past two+ years. I want to express my deep gratitude to Mary, without whose design talents and expertise, we would not have as professional a journal as we do.

My appreciation also goes to Jeff Rubin, who so kindly agreed to write his adroit book reviews for our journal.

A swooping genuflect goes to the APS Officers and Governors, especially Ray, for their trust in me throughout my tenure as editor and steward of *The Polar Times*.

Above all, thank YOU, our devout readers, for giving me this rewarding opportunity to both share and fuel my passion for the polar regions. Though I am vacating my editor's chair for someone new to settle into, my commitment to casting light on issues affecting the Far North and southernmost reaches of our planet shall not wane.

With beholden apologies to Dylan Thomas:

"Rage, rage against the dying of the light
I will not go gentle into that 'polar' night..."

–Moki Kokoris, Editor

Enhancement reminder: To access supplemental videos or websites, download a free QR-code reader app at: www.i-nigma.com/downloadinigmareader.html. Launch the app, point your smartphone camera at the QR square, and voila!

The APS seeks a new Editor+Art Director team for its biannual 40-page print-only magazine. Editor's position is non-salaried. Desired qualifications: experience in editing/publishing/production, comprehensive grasp of past and present activity in both polar regions, and a broad network of contacts from whom contributions may be solicited. Send resumes to: americanpolar1@gmail.com

AMERICAN POLAR SOCIETY

The American Polar Society was founded on November 29, 1934, to band together all persons interested in polar exploration. Members are entitled to receive *The Polar Times* twice a year. The American Polar Society is classified as a tax exempt organization under Sec 501(C)3 of the IRS Code.

For more information about the American Polar Society, contact us at: americanpolar1@gmail.com.

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Polar bear Photo: © Florian Ledoux 2020

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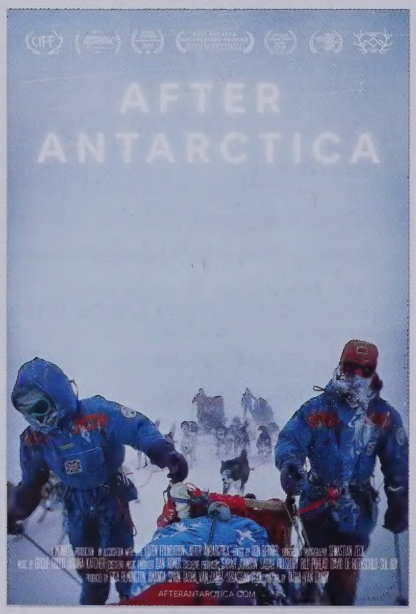
HONORING A POLAR LUMINARY

AFTER ANTARCTICA

1990 International Trans-Antarctica Expedition. Photo by Per Breiehagen.



Documentary film directed by Tasha Van Zandt

Producer: Sebastian Zeck
United States, 2021

After Antarctica offers an unprecedented, intimate portrait of Will Steger. A formidable voice calling for understanding and the preservation of the Arctic and Antarctic, Steger is best known for his polar explorations. The documentary film follows him on a solo adventure through the Arctic while reflecting back on the legendary Trans-Antarctica Expedition. It explores how his observations and life's work have influenced the conversation about climate change.

In 1989, Steger led an international team of six scientists and explorers on the first coast-to-coast dogsled traverse of Antarctica. The International Trans-Antarctica Expedition followed a 3,741-mile route and took 220 days to complete. The ultimate mission was to draw global attention to Antarctica's changing climate and to use the expedition as a tool to renew the Antarctic Treaty, which would protect the continent from mineral exploitation. Even with his background in science and knowledge of the changing climate, Steger could never have expected what he would soon discover. This arduous expedition opened his eyes to the most pressing issue of our time and ultimately changed the course of his life.

Thirty years later, Steger heads out on the ice once again, this time to the opposite end of the Earth, recounting the legendary, life-changing journey that led him to where he is today.

For over 50 years, Will Steger has inspired thousands of people through his chronicles of Arctic and Antarctic adventures and his remarkable eyewitness account of climate change impacts on our Polar Regions. Now, we are all eyewitnesses to climate change and we all have a climate story to tell. Climate change is complicated and can often feel far removed from our lives. Sharing

To access the "After Antarctica" film website, scan this QR code.

our personal stories about climate change places facts into context, and makes them relevant to our everyday lives. Connecting the head and heart on these issues is essential for sparking sustainable initiatives.

While each personal account describes unique experiences and observations, ranging from despair to hope, or from loss to resolve, these stories are nevertheless individual perspectives. The true power to shift the narrative lies in the collective exchange of ideas, where along with the ability to listen with compassion, we can find the common ground upon which to build the foundation for positive change that will be of benefit to all.

In the decades since the International Trans-Antarctica Expedition, the three ice shelves the team crossed have disintegrated, leaving Steger and his team as not only the first to achieve this historic feat, but also the last.

Having testified before the U.S. Congress on polar and environmental issues, he has become a recognized authority on polar environmental concerns.

Now, Steger enters a new chapter as he comes to the realization that the legacy he has fought to preserve has begun to melt away. As the debate on the urgency of climate change polarizes the world, and the intensity of natural disasters increases, he begins to face his own mortality alongside that of the planet's.

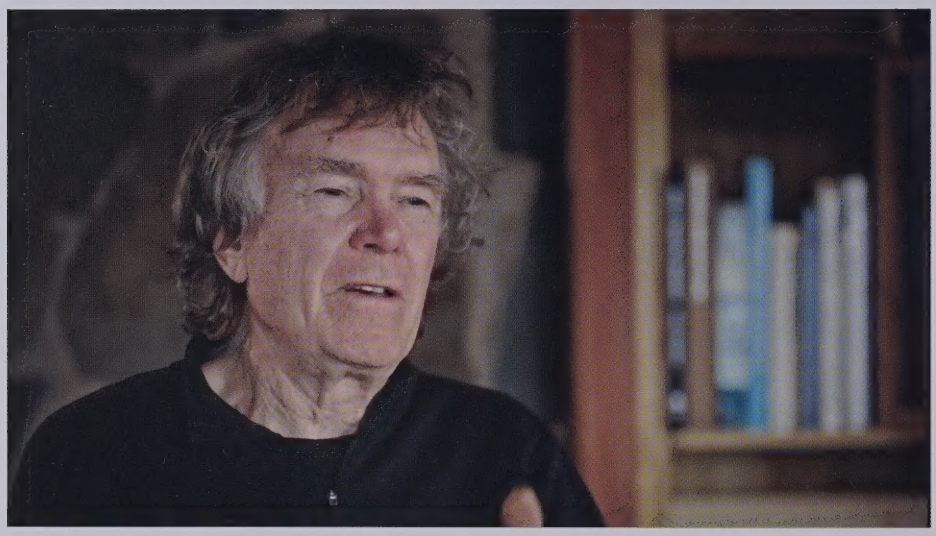
Will Steger currently lives off-grid in Ely, Minnesota, in a log cabin built entirely by hand. When not on expedition, he spends his time educating people about climate change through his Climate Generation nonprofit organization. Even at 77, he has no plans of slowing down, his next journey already mapped out: a two-month solo expedition north of the Arctic Circle in Canada.

Tasha Van Zandt in her own words:
Long before humankind developed the tools to read or write, we shared information through storytelling. It is a communication device that connects us. The stories

From the Trans-Antarctica Expedition footage voiceover:
"We heard they demolished the wall between West and East Berlin. That's going to unify us for the tasks that lie ahead. The real goal now is the Antarctic Treaty." -Will Steger, November 1989

Will Steger hauling his canoe sled.
Photo by Tasha Van Zandt.

Above: Will Steger with one of his sled dogs, courtesy of Will Steger.
Below: Will Steger at home . Photo by Tasha Van Zandt.



passed down from elders help shape future generations and show us how to better understand our world. As we look back on our history, we realize that stories of our past guide our present.

From the Chauvet Cave paintings found in France, or the songlines of Indigenous Australians, to the Epic of Gilgamesh and Egyptian hieroglyphics, these are all messages from the past left for future generations. They grant us the capability to build cultural bridges that facilitate and nurture greater global understanding.

As an avid and passionate narrator, I believe that documentaries are one of the most compelling forms of storytelling, as they allow others to see the world from a new perspective. I view them as a tool for connection, education, and growth. Documentaries can also motivate us to evaluate and ask critical questions of ourselves and the world around us, offering us answers that can transform our own worldview. As a documentary filmmaker, I am driven to tell stories that spur change. When I first met Will Steger, I knew his was a story that could have great impact on the world.

My fascination with Will began at a very young age. Growing up in Minnesota, Will Steger was a hometown hero. Everywhere I went, people were sharing tales of his legendary conservation-focused treks. When I was given a *National Geographic* magazine that featured his expeditions, I was immediately inspired by the otherworldly images and the way he had used those undertakings as a tool for international cooperation. They were his platform and a means of effecting change. His work had such a direct impact on my own personal endeavors of documenting our natural world that I began leading student expeditions with National Geographic around the globe.

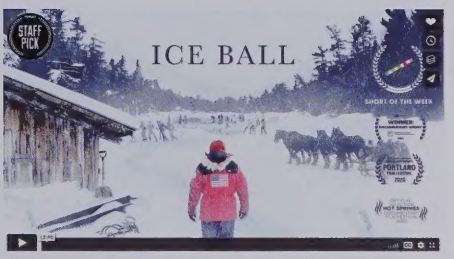
I finally had the opportunity to meet Will Steger after a talk he gave on his Trans-Antarctica Expedition, and instantly felt the impulse to tell his life story. The more time I spent getting to know Will, the more I recognized the influence of the Trans-Antarctica Expedition on his life's course.

There is no doubt that sharing Will's journey through this documentary has the power to inspire others in much the same way he has inspired me. Will's perseverance through hardship is a testament to the power of the human spirit, and I remembered his philosophies and approach to life as I faced my own challenges. In times of adversity, Will always found strength and meaning to carry on by focusing on the greater purpose. For him, the polar expanses have been not only places of incredible adventure and science-based discovery, but also places for healing. As Will states in the film, in times of hardship he leans on the wilderness and finds solace within it.

By making this documentary, I myself have come to understand that our health as individuals and the health of our planet are interconnected. Though we may not always be able to control change around us, we can change our responses. *After Antarctica* is Will's own climate eyewitness story. As the planet continues to change,

Climate Generation – A Will Steger Legacy website

Will Steger at home . Photo by Tasha Van Zandt.



Ice Ball short (Vimeo)
A short documentary centered around Will Steger, the legendary polar explorer, as he inspires a community by preserving the forgotten craft of ice harvesting.

TOP: Will Steger with one of his sled dogs, courtesy of Will Steger. ABOVE: 1990 International Trans-Antarctica Expedition team members huddle together behind a dogsled during a lunch break. Photo by Will Steger.

and we, too, witness the impacts, each of us will have our own stories to tell. I myself am finding solace in the mindshift the sharing of these stories can bring.

Tasha Van Zandt – Director

Tasha Van Zandt is a documentary filmmaker who has traveled on assignment around the globe and to all seven continents. Her work has been published in National Geographic Expeditions, *Time* magazine, *The Guardian*, PBS, NPR, and others. Throughout her work, Tasha is dedicated to capturing stories that foster empathy, using her lens as a tool to build cultural bridges that lead to greater global understanding.

Sebastian Zeck – Producer

Sebastian Zeck is a documentary filmmaker and photographer with a focus on conservation and stewardship. He has produced and shot for clients such as Google and *Time* magazine, and has worked in multiple locations around the world including the Canadian Arctic and Antarctica. Sebastian began his career in the social justice and nonprofit sphere, seeking to blend the craft of filmmaking and storytelling to effect social change.

Will Steger Wilderness Center

The Steger Center vision was born during the Antarctica Expedition as a detailed drawing of the five-story center designed to develop and connect leaders. The dream is to build a center that in turn nurtures the community, takes care of the Earth and inspires leaders to tackle real world problems. With community spaces, master classes and international leadership conferences – the Steger Center has a vision to build a sustainable community in the NorthWoods to inspire future generations of leaders.

SOLITUDE AND SURVIVAL IN THE SOUTH

Rothera Research Station. © Photo by James Bowyer

by James Bowyer

STANDING ON THE DEVON COAST, MY PHONE RINGS. "Hi James, we'd like you to look after Rothera for us. Are you happy to take the job?"

"Yes, of course!"

Cue a moment of panic. After an hour-long interview only that morning, I have just signed up to work in Antarctica for eighteen months, providing medical cover for a research station of 27 people in the winter, 160 in summer. I would be the only doctor for at least half of that time, with only narrow windows for medical evacuation in case something goes wrong. My patch in the summer consists of an area the size of Europe, with deep-field teams scattered in some of the harshest environments on Earth.

But then again this is a job I'd been working towards for a decade. Starting as a medical student reading about the desert explorer, Wilfred Thesiger, I had slowly expanded my interest into other remote environment pioneers and had become enthralled with the exploits of Scott, Shackleton, and the other expeditions of the Heroic Age of polar exploration. Sitting reading about them in a damp flat in Fulham, it suddenly struck me that I could be doing this myself rather than just reading about it.

This journey culminated in me beating seventy other hopefuls to a place, and arriving in Plymouth to start training in all the skills that I might need in Antarctica. Whilst my six years of work in general and emergency medicine and anaesthesia put me in good stead for dealing with a sick patient, I might need to be able to take an x-ray, fill a tooth or recompress a diver with the bends if I was to effectively cover the needs of my fellow polar residents.

Six months later, I was packing my bags to fly south to start my tenure at Rothera Research Station, operated by the British Antarctic Survey (BAS). Positioned on a small isthmus on an island just off the Antarctic Peninsula, just inside the Antarctic Circle at 67°S, our station is not much to look at from the outside. But the location is spectacular.

When I first arrived, sea ice covered the bay as far as the eye could see, only to break up and be replaced by icebergs providing an ever-changing backdrop to the activities on station. The glaciers start on our doorstep and open up into a wide ice piedmont, punctuated with nunataks and mountain ridges just waiting to be explored.

The British presence in Antarctica had a strong focus on scientific research from the outset. This has continued through from the inception of BAS in 1962 to the present day. Whilst the station is a research centre in its own right, with permanent marine biology, oceanography, meteorology, and upper atmosphere research projects and long-term continuous data collection, one of our main functions in the summer is to provide air access to the continent.

This allows for BAS in-house and collaborative partner science teams to conduct

All photos by James Bowyer unless otherwise credited

world-leading research into glaciology and climate change, looking at how the climate has changed over the millennia and what effect the changes we are experiencing now are having on the vast ice sheets and glaciers that make up most of Antarctica. These can vary from small, highly mobile two-person parties up to the huge, multi-year, multinational collaborative projects currently in place on the Thwaites ice shelf.

My day-to-day work is generally straightforward general practice-style medicine, complicated by our location and remoteness. Our teams are all medically screened prior to departure but acute conditions and minor injuries can and do occur. With my background in anaesthesia and critical care, I am used to looking after some of the sickest patients with the resources of a large, modern hospital. Here, I really have to go back to basics and rely on my clinical skills and acumen to diagnose and treat the problems that present to me. I have to do my own x-rays and laboratory tests and, even then, the available options are limited. Fortunately, I am backed up by the British Antarctic Medical Unit (BASMU) based in Plymouth and can get expert advice within hours, if not minutes. Most of the environmental diseases that I encounter are disrupted sleep cycles due to the eccentric light patterns and dry skin from low humidity, rather than the expected frostbite or hypothermia.

The challenges I face vary from the expected; limited supplies and having to come up with imaginative solutions to illnesses that normally have clear referral pathways in the UK, to the more unusual; how to have a normal lunchtime chat with someone who you were minutes before counselling for a potentially embarrassing personal problem. In such a small community, medical confidentiality is both key and a challenge when someone is discussing their injury at the bar in the evening.

This year has seen innovations in our practice, with our first use of high-definition videoconferencing to facilitate the examination of a wound by a plastic surgeon based in the UK, allowing for the rapid formulation of a time-critical treatment plan.

Life on an Antarctic research station is unique. Classified as an isolated, confined environment (isolated from the outside world, confined in that we can't leave), it is no wonder that psychologists have studied research stations as proxies for long-term space travel. Despite our comfortable living conditions, we are heavily dependent on our life support systems. If the generators or water production plant break, we could suddenly be left in a tenuous situation, exposed to the harsh realities of our location.

We have to be self-reliant and self-contained, as resupply is intermittent at best, and impossible over the winter. We rely on each other in a way that isn't always visible back in the real world, with everyone on station having a vital role to play, from scientists and engineering staff to the electricians, plumbers and mechanics that keep

Pancake ice by dawnlight, looking out across Laubeuf Fjord.

Clockwise from top: Moonlight over the Wormald Ice Piedmont and Reptile Ridge; The Rothera Research Station doctor's surgery; A pyramid tent by moonlight.

the lights on, water running and vehicles working, not to mention the chef that keep us fed and happy.

The doctor, as a mostly reactive job, gets a plethora of ancillary roles attached to it; I am now a deputy subpostmaster, shopkeeper, binman and viral researcher on top of being on-call twenty-four hours per day, seven days per week.

Our first summer season was a whirlwind of the flying program; routine maintenance, major construction projects including the wharf that will service the *RRS Sir David Attenborough*, and the continual flux of personnel coming in and out the station. As such, the morning that the ship left with the last of the summer staff was a moment of relief for those who were staying behind.

The Antarctic winter is a challenging but personally rewarding time that drew many of us down here in the first place. The wildlife, so plentiful and varied in the summer, slowly starts to vanish as the days shorten and the temperature drops. Slush, pancake ice and finally fixed sea ice forms over the bay and the silence becomes all-consuming. The moment when you realise that the only thing you can hear is your own blood pumping is bizarre and sublime.

Likewise, smells fade and disappear as everything freezes, and the twilight gloom

The Antarctic winter is a challenging but personally rewarding time that drew many of us down here in the first place. The wildlife, so plentiful and varied in the summer, slowly starts to vanish as the days shorten and the temperature drops. Slush, pancake ice and finally fixed sea ice forms over the bay and the silence becomes all-consuming. The moment when you realise that the only thing you can hear is your own blood pumping is bizarre and sublime.

reduces the world to shades of white and grey. However, this canvas puts all the phenomena of Antarctica into vivid relief. The six weeks over midwinter, where the sun does not rise above the mountains, were punctuated by the most glorious displays of colour in the sky as the invisible sun highlighted the clouds. I'll never forget the delicate nacreous clouds high in the stratosphere shining with pearlescent beauty; or the moment I felt the first rays of sunshine on my face after more than a month of darkness; or waking to hoarfrost coating every surface outside, only to disappear completely a day later.

Winter forces you to be creative as forced time indoors can quickly become stale and repetitive. Nothing is handed to you although we are lucky to have access to a supply of materials and talented people to keep us entertained. Music, art, sports and crafts have all had their moment, with everyone digging deep to make intricate and thoughtful gifts for Midwinter's day, our proxy for the holiday season. We've made films, had old-school LAN parties, skied down the glacier dressed as dinosaurs, and spent weeks off station climbing mountains and exploring down crevasses whilst living in tents.

COVID-19 has had a huge effect on the organisation, as it has on everyone over the last year. We have been incredibly fortunate to escape the virus itself at Rothera. This has been through the sterling work of BAS, BASMU, the government of the Falkland Islands and the Antarctic community as a whole, leading to risk stratification and strict quarantine procedures for all staff coming south, and a complete rejigging of plans for the coming summer season.

Our winter, originally scheduled for five months, has now expanded to almost double that. We have all felt incredibly lucky that we have been able to continue living relatively normally and have a lot of sympathy for those that have found themselves cooped up indoors, as we keep up to date with the ongoing situation through online news and communications with friends and family.

Coming down to Antarctica, I knew I would have a lot to discover about living here. But now I realise that it is going to be my return home in March, after several weeks on a ship, that will be the real learning experience, as I adjust to social distancing, masks, and having to learn how to treat a now-common disease I have never seen before.

As I approach the end of my time down here, I'm looking around me at the amazing people who have supported me through this and whom I have gotten to know so well, at the elephant seals sitting obstinately on the runway, at the doorway that needs digging out yet again, at the time away from family and friends, to an uncertain future after such a landmark experience in my life. Would I advise someone else to seek out this opportunity? Absolutely. If you are willing to take up the challenge.

Permission generously granted by "Discover Interesting."More photos may be found at the following link: https://discoverinteresting.com/opportunity-series/solitude-and-survival/

From top: Ops tower at sunset.
RRS James Clark Ross *alongside Rothera's newly completed wharf.*

James Bowyer is a doctor for the British Antarctic Survey. From 2019-2021, he was based at the Rothera Research Station, a centre for biological research and a hub for supporting deep-field and air operations.

James Bowyer (Photo credit Sam Hunt)

Rothera – British Antarctic Survey's main research base, as featured on antarcticglaciers.org.

Rothera Research Station live webcam.

TUSK GOES TECH

by Martin Nweeia

SUBMERGED AND STANDING on the floor of the Arctic Ocean, you look up for an instant and see ice overhead, glimmering rays of light penetrating a section of open water. Then from a distance, a family of narwhals swims toward you – a tusked father, a mother and their young calf. From within the cacophony of ocean sounds emerges the voice of Meryl Streep, who introduces you to narwhals, the Arctic Ocean, the Inuit, and Microsoft's HoloLens. You are, at the same time, both fully engaged and lost in the experience of an immersive shared physical space.

Where are you? From an observer's point of view, you are in an ordinary room with sparsely spaced furniture but otherwise open. Yet, once you pull the HoloLens headset on, you are instantly transported to the Arctic. And soon you find yourself in the water swimming with narwhals.

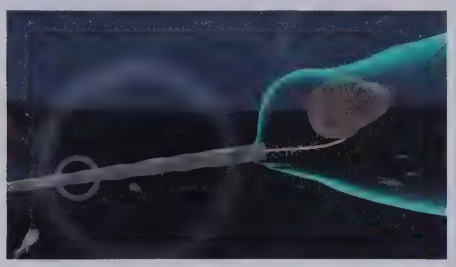
It was an initiative that began in 2017, inspired by HoloAnatomy® Software. I had observed medical students interacting and learning human anatomy with the aid of Microsoft HoloLens, an autonomous self-contained mixed reality device, worn as goggles, that enables the user to visualize holographic anatomical parts of the body. During a presentation by the Interactive Commons team at Case Western Reserve University [CWRU], once I grasped the technology's potential, I turned to my wife and said, "I'll be doing this with narwhals." Instantly, I imagined holographic narwhals 'swimming' in museums around the world. Interaction with 3D creatures and objects could completely transform the way visitors experience a museum exhibit. Supported by a grant from the National Science Foundation, together with an experienced team at the Interactive Commons and our own creative 3D holographic art-engineering team, we began designing HoloLens Narwhal. Collaborative group meetings were arranged for scriptwriting and generating holograms, and before long, the story of this iconic whale and its extraordinary tusk emerged.

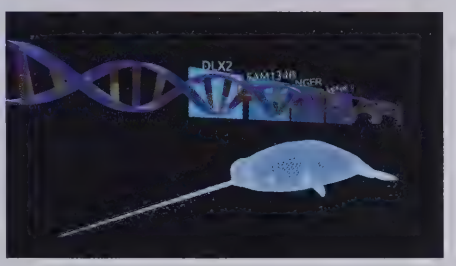
Narwhal chasing a school of fish.
Photo © Florian Ledoux

About HoloLens

Developed and manufactured by Microsoft, Hololens is a relatively new augmented mixed reality technology that continues to transform the application and methods of learning. Built into the smartglasses headset, the processor facilitates a full experience of sound,

Photos by permission from Martin Nweeia





From left: Team photos: Narwhal tusk brain diagram through HoloLens headset; Viewers looking through HoloLens headset; View through HoloLens headset. Photos by permission from Martin Nweeia.

sight, and exploration of holograms within a given space by superimposing virtual objects over one's actual field of vision. Unlike the isolation of virtual reality that transports the wearer into a different world, Hololens brings holographic wonders into the wearer's world.

Anyone wearing Hololens is fully aware of the room they are in and of others sharing that space. If the other people are also wearing Hololens headsets, everyone can interact with the same holographic image while still seeing one another in the same surroundings.

The recent application of this technology to educational platforms was given to Case School of Medicine, under principal investigator Dr. Mark Griswold, to teach human anatomy in their medical school. The Interactive Commons at Case is helping to facilitate this transformation in medical education. Other disciplines are also utilizing this technology in myriad career fields including science, architecture, design, and art. Interactive Commons brings together diverse expertise to solve complex problems, supported by visualization. At this institute, dedicated teams of computer programmers, 3D modelers, artists and curriculum creators work together to develop applications for Microsoft HoloLens and other visualization technologies.

View through HoloLens AR headset.

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Among its early triumphs, the CWRU Interactive Commons team, along with partner Cleveland Clinic, developed the HoloAnatomy® application for the HoloLens platform, which is currently the primary anatomy-learning tool for CWRU medical students. In January 2017, the team provided Microsoft HoloLens demonstrations to leaders at the World Economic Forum Annual Meeting in Davos, Switzerland.

Our new team was pioneering the augmented mixed reality space by diving deep into the Arctic Ocean. Along with other Inuit, Charlie and Enookie Inurak are full collaborators in the research described in the HoloLens Narwhal Experience. They have collectively aided and directed much of the science on the narwhal.

Under the three-year NSF grant, I was able to collect the most extensive and comprehensive bodies of Inuit knowledge about the narwhal, and was a "Highlight" in the NSF report to the US Congress in 2007. Two Inuit hunters traveled to Washington D.C. to bring the Inuit knowledge perspective to the Arctic Crashes Symposium in 2016. (The Smithsonian's Arctic Crashes project is an international collaborative study exploring the history of polar animal fluctuations and the shifting scientific, cultural, and public interpretations of human-animal interactions in the Arctic.) These same hunters assisted with the Smithsonian exhibit, *Narwhal: Revealing and Arctic Legend*, which I co-curated.

Inuit hunters and elders were also included in the *At The Poles* and *Arctic Crashes* books, both published by Smithsonian Scholarly Press. The companion book to the exhibit *Narwhal: Revealing an Arctic Legend*, which I co-edited and published in 2017, won the William Mills Prize for polar nonfiction. All of these endeavors include invaluable Inuit knowledge.

It was therefore essential to bring their perspective to our HoloLens Narwhal project. A holographic Inuit narrates part of the HoloLens Narwhal Experience, and one of the hunters who participated in the Arctic Crashes Symposium narrates part of the story and introduces the listener to their *Isuma* or knowledge.

Tusked narwhal porpoising. Photo © Florian Ledoux

The story of the HoloLens Narwhal Experience

A Hololens guide takes participants through the experience as they examine this Arctic whale up close. He also points out the discoveries made by integrating Inuit knowledge with scientific research. First, a giant three-dimensional globe appears in front of the participants, focusing on the northern regions and the geographical distribution of the narwhal in the waters between Greenland and Baffin Island. After the general information is presented, the globe disappears, and swimming narwhal approach the participants. Then the guide presents some background on recent scientific discoveries conducted by the principal investigator. Afterwards, an Inuit elder walks toward the group on an ice floe and describes the traditional knowledge that has augmented the body of science, including aspects of anatomy, tooth morphology, migration, distribution and behavior. The partnership between Inuit and scientists is highlighted. Continuing on, the guide walks the visitor through a series of anatomic landmarks and the narwhal's physiology, as much focusing on the tooth sensory organ system as on describing insights gathered from sequencing the narwhal genome, both investigations that I continue to pursue. Future studies and the significance of genomic research will inform the visitor of the value of such work. Finally, the participants engage in an interactive holographic game of stunning oncoming fish as their own heads take on the appearance of a narwhal with a tusk, which like the real whale, has the ability to disorient its prey, a theory that helps explain how narwhals forage for fish that swim faster than they do.

The guide and narrator

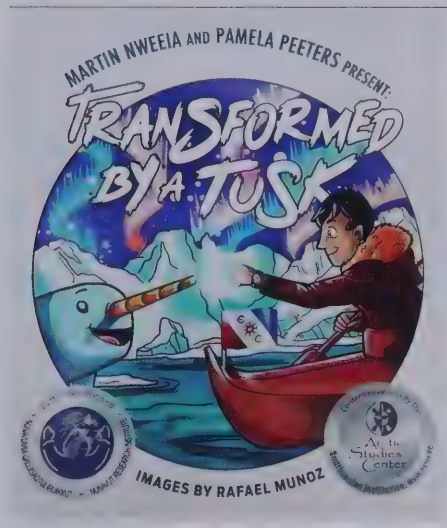
When I asked Meryl Streep if she would narrate the experience, her response was "Yes, yes and yes!" I always felt that any production is better with a healthy dose of Meryl. She brings such an understated elegance and grace to the script, and even the holographic narwhals enjoy her company. The experience was greatly enhanced with the addition of her voice.

The Experience first debuted at the Smithsonian Institution's Q?rius – The Coralyn W. Whitney Science Education Center at the National Museum of Natural History, and then traveled to the American Association for the Advancement of Science.

Thus far, visitors to the installation have been in complete awe. "It's almost overwhelming for them," says Erin Henninger, Executive Director of Interactive Commons. "You've taken an interactive experience and gone a step beyond that." Hololens is tapping into our inner need to delve deeper into our environments. We want to experience our world more deeply, and this technology helps to merge experience with reality. Where did we go from there? The HoloLens Narwhal Experience traveled to Nuuk, Greenland in June 2021, and in early July, it was featured at the Global Exploration Summit [GLEX] in Lisbon, Portugal, with presentations and demonstrations to the world of exploration.

Dr. Martin Nweeia is assistant professor for innovative programs at the Case Western Reserve University School of Dental Medicine, Researcher in the Harvard Catalyst, at the Smithsonian Institution, and the Canadian Museum of Nature. As a Fellow of anthropology and vertebrate zoology at the Smithsonian, he was co-curator of the narwhal exhibit, *Narwhal: Revealing An Arctic Legend*. He is a Fellow of the Explorers Club and a Lowell Thomas Award winner for his work in Arctic research. Dr. Nweeia is also lead investigator, producer, writer, and director for the HoloLens Narwhal Experience.

Martin Nweeia and Pamela Peeters in the Arctic.



Cover and pages from "Transformed by a Tusk" – an "ECO HERO" graphic novel, by Pamela Peeters.

TRANSFORMED BY A TUSK

An "ECO HERO" graphic novel by Pamela Peeters

THERE ARE MANY BOOKS available today that touch upon the theme of Planet Earth and how to take care of her. But there are none that bring you an "Eco Hero" personality, except one. This one presents Dr. Narwhal and Mother Earth in a transformative Arctic adventure, which blends science and traditional indigenous knowledge.

Allow me to introduce *Transformed by a Tusk*, a newly released graphic novel I co-authored with the world's leading expert on the narwhal tusk, Dr. Martin Nweeia, who unraveled its mystery over the course of 18 expeditions to the Canadian and Greenlandic Arctic. Each of us has also published our own respective research results separately: more tooth and narwhal-related work by Dr. Nweeia, and earth sciences and environmental education by me. The blend of our backgrounds and aspirations resulted in a new form of education.

Increasing Awareness, Guidance and Engagement

The graphic novel is a vehicle for transforming a person's mindset about what we can all do – in our own daily lives – to help our planet, which is showing serious signs of distress. The messenger of this quest is none other than *Eco Hero*, a warrior for truth and light, who protects the vast natural resources of Mother Earth. She is gifted with special powers and uses them to assist those who call for help. Her mission? To preserve and restore the balance of life!

In this first adventure, Eco Hero is called by the narwhal's to come to their help and will meet Dr. Narwhal in Baffin Island. Together, they will learn about the legend of the Narwhal, solve an imbalance and will inspire the young Inuit girl Suka to become a guardian for our planet too.

Eco Hero has an important message for the readers: "when you listen to the language of Mother Earth and come to her help, good things happen." Together with her loyal hedgehog assistant, she hopes to inspire a new generation of planet protectors to take care of the environment, our communities and … themselves.

Smithsonian National Museum and More

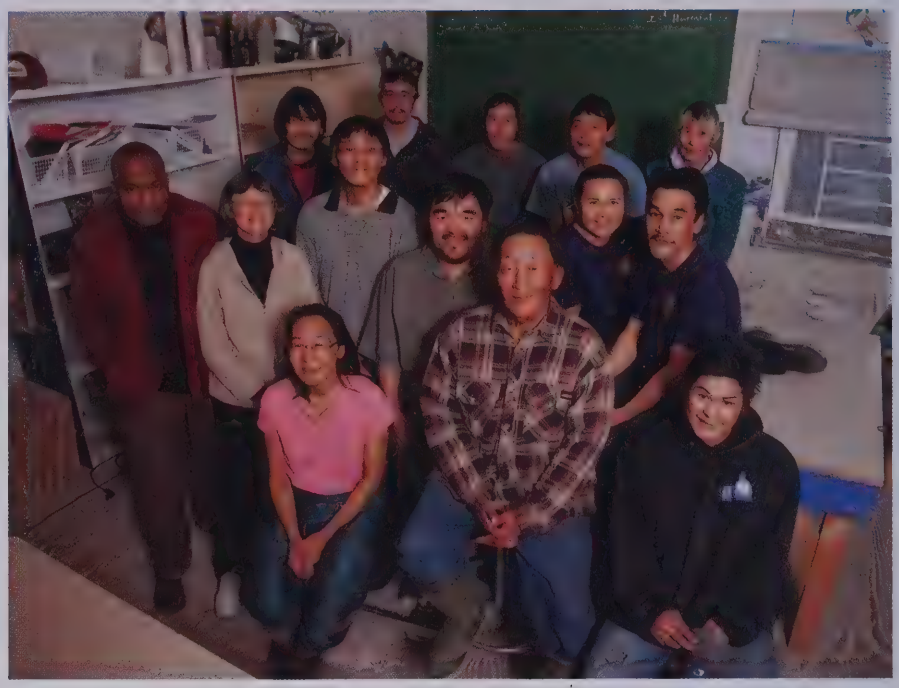
The *Transformed by a Tusk* graphic novel is the companion book of the Smithsonian National Museum of Natural History's "Narwhal: Revealing an Arctic Legend" exhibit that will begin traveling once COVID restrictions have ended. It was first introduced to the young cubs of the Explorers Club (the first club for science and exploration) and was extremely well received since all ages were catered to, and interactivity was encouraged through coloring pages for the little ones, a search for 13 SDGs and 12 questions for school-aged children. All eyes are on youth as they are going to be the next generations of leaders for our planet. They need the tools to make that happen. Visit the Eco Hero Lab website and access the online portal for downloads and videos.

Pamela Peeters is an environmental economist specializing in sustainable development. She is also a former Research Fellow in Economics from Columbia University, a current Fellow of the Explorers Club and a Certified National Geographic Educator. At 12, she launched her first environmental magazine called *Grab the Green*, with the purpose of informing people about the benefits of a green economy and of creating a more caring relationship with our planet. "Eco Hero" is a character invented in 1999, and brought to life through a workshop, a learning center, a pop-up sanctuary, and now a first graphic novel. This novel is currently available in English and will also be published in Dutch thanks to the support from the Delegation of Flanders to the USA. An "Eco Hero" exhibit is in development as well, with special attention to the call of the narwhals! For more information, visit: www.myecohero.com and www.pamelapeeters.com.

My Eco Hero website

INUIT ART IN THE KIVALLIQ

A Panorama of Inuit Creativity
by Jim Shirley



Matchbox Gallery Artists:
Back Row, R to L: Helen Iguptak, John Kurok, Jermaine Napayok, Pierre Aupilardjuk.
Middle Row, R to L: Roger Aksadjuak, Tanya Tungilik, Philip Ugjuk, Leo Napayok, Jack Nuviyak.
Front Row, R to L: Philip Napayok, Yvo Samgushak, Amauyah Noah, Sue Shirley, Jim Shirley.

IN THE SPRING OF 1979, I found myself stepping out of a Transair DC-3 and making my way across a tarmac of hardened earth to a crude but functional quonset hut, which served as the airport terminal back then. I had just been hired by the Government of the Northwest Territories as an Arts and Crafts Development Officer. I was to work with artists, crafts-persons, and government-created arts facilities that had become active in the region over the two decades prior to my arrival. As an artist who had spent most of my adult life committed to creative discovery, I was aware of the opportunity my job provided me to interact and learn from some of the world's most gifted natural artists. I was honoured to have arrived at a time considered by many to be the most creative and prolific in the history of Inuit art in the Kivalliq.

The Keewatin (or the Kivalliq, as it has come to be known) is a place where artists experience the balance and symmetry that link all living and non-living things. I grew up with the experiences one encounters in an urban setting. Here, the balance was much more perceptible. You could see the land in the faces, and hear it in the voices of the people. It was evident in their art.

There was a nearly constant stream of artists flowing through the craftshop, coming to either sell or show their imaginative work. Often, people traveling to and from other communities would stop in to chat. Daily, I saw hundreds of works of art in every medium, from abstract works to traditional implements and clothing. It was a panorama of Inuit creativity.

At the time, the focus was on the production of fabric-based crafts. The government was still trying to create a source for a self-sufficient economy for the Inuit who had relocated there in the 1950s to work in the North Rankin Nickel Mine. Throughout the building, there were wonderful examples of ceramics. In another location, there were benches, vises, and rough pieces of soapstone. Along with drawing and fabric art, soapstone-carving had been another activity at the workshop.

Much of the original vibrant energy was still evident. With Claude Grenier as its founding manager, it was one of the most innovative programs of its time – a starting point for many of the best artists in the region.

The program was multidisciplinary and was strongly based on Inuit principles. Family members worked side by side; husbands and wives, parents and children.

Endings Become Beginnings

Government involvement in arts programming was entering its most volatile period. The government's withdrawal from the operation of craft-shops in the early 1980s was a traumatic experience for those of us who had begun to view the role of government as an integral part of protection of northern culture and for Inuit who had come to rely on them as a source of livelihood. This disengagement, however, created opportunities for visionary folks like Keith Rawlings, Marie Bouchard and others like myself who saw potential in encouraging Inuit art on our own.

Art provided a visible expression of a renewal of the legendary capabilities of Inuit to adapt to change, whether that change came from the environment or from the tremendous upheaval of their accelerated introduction to southern lifestyles and values. In the late '70s, the intensity of this momentous shift was reflected in their works. The same is the case today. For a culture that had never known or needed to know the

Photo credit for all images: © Michael Nelson

function or purpose of 'art,' their visual expressions became an essential element of their new identity in a rapidly changing world. Experimenting with expressive media that were not traditional, Inuit drew confidently and fluently from the deep well of their narrative and cultural memories.

An Artistic Vision Unfolds

The Matchbox Gallery opened in May of 1987. In 1988 to 1989, with government support, a large extension to the existing building was added, which more than doubled the operating space. This area enabled us to begin our ceramics program. Our first ceramics workshop began with a group of younger carvers who were then active in the community. Yvo Samgushak and Laurent Aksadjuak came out of retirement to work once again with ceramics, and to teach a young group of beginning ceramists. With the help of the Department of Education, we presented a basic ceramics training program which was tremendously successful.

A Literacy of Touch

One of the senses that is least developed in 'southerners' is the sense of touch. In our cosmopolitan lifestyle, we created tools, which have replaced our hands. For northern people, the ability to manipulate materials with their hands, to fashion tools, shelter and clothing out of limited natural resources, was the cornerstone of their ability to survive.

The artwork that comes out of the North, the Inuit communities in particular, is a testimony to their strength and aptitude to creatively manipulate materials in all kinds of circumstances. These abilities are still very present in women who work with skins, and retain incredible detail in the construction of garments, and in men who still maintain their traditional land and tool making skills. Understanding the nature of materials, and manipulating those materials using a refined sense of touch, are qualities that are essential for working with clay.

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"Shaman's Muskox" by Roger Aksadjuak.

A Strong Sense of Spatial Reasoning

I've often been amazed at the ability of northern people to see objects and animals from far away. It isn't just a matter of keen eyesight, but of careful observation and discernment. There is a type of logic to this ability, particularly in nomadic people whose aptitude to spot game over long distances determined whether they lived or died.

The ability to correctly 'read' what is in front of you is another aspect of working with form in three dimensions, whether it is clay or stone. It is this mastery that Inuit bring into their creative efforts, making them some of the world's most naturally gifted artists.

A Communal Approach to Learning

The foundation of our programming is communally-based shared learning system. In communicating with one another, people reinforce traditional communication and values. Young adults benefit from positive and supportive interaction with others, which helps them develop self-confidence and social skills. Working as a group lends the finished piece its collaborative style while still respecting individuality.

Video to an interview with Jim and Sue Shirley of Matchbox Gallery on Rankin Island in Nunavut

The Matchbox Gallery & The Kangirqliniq Center for Arts and Learning

THE ENCHANTED BEAR

An example of the Matchbox Gallery approach to collaborative ceramics by Roger Aksadjuak, Jack Nuviak, John Kurok and Leo Napayok. Created in 2013, each artist made a personal stylistic contribution in consultation with other creative artists.

Website of Matchbox Gallery

BOX 157 – RANKIN INLET NUNAVUT

Website of the
Kangirqliniq Center for
Arts and Learning

· 867.645.2674 · WWW.THEMATCHBOXGALLERY.COM/

Clockwise from top:
Incised polar bear head, by Jack Nuviyak and Leo Napayok.

Photo of Sue and Jim Shirley at Matchbox Gallery.

"Spirits on a Boat Trip" by Jermaine Napayok.

"Three Birds" by John Kurok and Leo Napayok.

"Remembering Elders" by Yvo Samgushak.

Inuit Sculptors from Nunavut – interview with Philip Ugjuka

"Messages from the Afterlife" by Pierre Aupilardjuk and Leo Napayok

"Under the Sea," by Roger Aksadjuak.

Roger learned ceramics by working closely with his father, Laurent Aksadjuak. Like Yvo Samgushak, Laurent was a veteran of the government-run project. Roger, who developed scenes with multiple figures as one of his themes, was a master at figurative hand-building.

Hand-building

All of our work is hand-built. The wheel is never used. Often, the low-relief incising of work requires that more than one artist work on a particular ceramic. Collaborative working is included in our arsenal of hand-building strategies. In many ways more than one artist working on a particular piece is more consistent with the traditional lifestyles (in which people most often worked collaboratively on projects that were important to their survival) than creating artworks in isolation. It also offers new expressive opportunities and is consistent with our search for creative discovery and expanded learning.

This workshop has become the anchor of the creative life of a community of Rankin inlet artists, a facility which is an unending source of pride and satisfaction to all of us.

Exhibitions and Collections

The ceramics produced through our programs have been featured in major exhibitions in New York, Vancouver, Seattle, Colorado, Minneapolis, Toronto and Germany. Our work has also been exhibited in shows in commercial galleries throughout Canada and the United States. Our artists have participated in hand-building demonstrations in the U.S., Canada, Iceland and Greenland. We were invited to display our work, and to participate and attend the "Ipakhak Ulumit: Nunavut Arts Then and Now" for the inaugural ceremonies for the creation of Nunavut.

Our gallery has several works in ceramics and other media included in the permanent collection of the Nunavut Legislative Assembly; the Prince of Wales Northern Heritage Centre; the Cerny Collection of Inuit Art in Bern, Switzerland; the MacDonald/Stewart Collection; the Winnipeg Art Gallery; the Museum of Inuit Art in Toronto; the National Gallery of Canada; and the Canadian Guild of Crafts in Montreal.

Segments republished with permission from *above&beyond | Canada's Arctic Journal* – the inflight magazine for Canadian North. http://arcticjournal.ca.

Video showing the creative process of the Inuit sculptors from Nunavut

REFLECTIONS ON U.S. POLAR SECURITY CUTTERS FOR THE 21ST CENTURY

by Lawson W. Brigham

From left: USCGC Polar Star *breaking ice in McMurdo Sound, Antarctica, with Mount Erebus in the background. January 13, 2018. U.S. Coast Guard photo by Chief Petty Officer Nick Ameen.*
USCGC Healy *during seismic operations in the Arctic Ocean, August 2011. Photo by Deborah R. Hutchinson, PhD.*

IN 2018, ADMIRAL KARL SCHULTZ, Commandant of the U.S. Coast Guard, redesignated the Coast Guard's polar icebreakers as *Polar Security Cutters* (PSC), which in some quarters was a long overdue decision. This decision carries over to the current ship acquisition program, which is now formally called the PSC program. The PSC decision overcomes decades of misunderstanding and a lack of precise articulation of what these polar ships are and how they represent U.S. national interests in Arctic and Antarctic waters. The Coast Guard generally understood the many missions that polar icebreakers conducted, and stated so in several interagency and U.S. National Academy studies. But others in the Congress, the Office of Management and Budget, key federal agencies and departments, and the White House never fully appreciated the range of missions these national polar assets supported until perhaps a decade ago. Internally in the Coast Guard and at the Department of Homeland Security (and before DHS, the Department of Transportation), budget issues loomed large, and other critical cutter and aircraft acquisitions took precedence over replacing the Polar Class icebreakers (*Polar Star* and *Polar Sea*), which had been operational since the mid-1970s. Initiating a program in a federal budget to increase the number of U.S. federal icebreakers was not a feasible option for several decades.

It is now clear that polar icebreakers are key components of American sea power and a unique capability in our global reach into all oceans. These ships are the visible, sovereign presence of the U.S. in Arctic and Antarctic waters. The word 'visible' is used here since the U.S. also operates nuclear submarines under the Arctic Ocean's sea ice cover, something we have done effectively since the voyage of USS *Nautilus* across the Arctic Ocean in 1958. These Arctic Ocean deployments by submarines remain critical to U.S. national security. However, the PSCs are *the* primary federal maritime law enforcement ships, as well as U.S. naval surface vessels (as all cutters are), wherever they sail in polar waters and on long transits to reach both ends of the Earth.

The range and diversity of current PSC missions are included in Table 1. As indicated in such a long list of key missions, the responsibilities of these unique, national assets are telling and comprehensive. A PSC commanding officer could be tasked with conducting any of these missions on Arctic and Antarctic deployments. Notably, the PSCs require a diverse set of skills from their crews, including support to embarked scientific parties and broad experience executing the 11 statutory missions of the Coast Guard. In many respects the multi-mission character of the 21st century Coast Guard is epitomized by the current and future operations of the Nation's Polar Security Cutters in the high latitudes.

It is important to recognize that the name change from Coast Guard polar icebreakers to Coast Guard Polar Security Cutters is consistent with the long history of the Service. When the U.S. became an Arctic nation with the purchase of Alaska from Russia in 1867, it was the U.S. Revenue Cutter Service, forerunner of the U.S. Coast Guard (formed by legislation in 1915), that made the earliest federal government contact in the new, northern land. The cutters, early polar ships (*Bear*, *Corwin*, *Thetis*, *Unalga*, *Lincoln* and others), provided the U.S. sovereign presence in the region where enforcement of federal laws, particularly those related to the regulation of sealing, were necessary. Revenue cutters supplied and provided health care to coastal communities, responded to maritime emergencies, and surveyed the new territory. In 1881, the cutter *Corwin* carried the noted naturalist John Muir to Alaska, establishing an early link for cutters supporting research and observations of the natural environment. These Revenue Cutter Service operations in the early days of Alaska as a U.S. territory, some performed in ice-covered waters, are the historical foundation for future (federal) maritime operations by PSCs in the U.S. maritime Arctic.

Naval operations by the Coast Guard in and around Greenland during World War II highlight the defense-security roles that the Coast Guard has displayed with its polar ships. The building of the Distant Early Warning Line (DEW) radar sites across Alaska, the Canadian Arctic, and Greenland during the Cold War required the use of Coast Guard polar icebreakers, showcasing a key national security role. Early U.S. presence and scientific research in the Antarctic in the 1950s and 1960s were supported by Coast Guard and Navy icebreakers, again illustrating the global reach of U.S. polar ships.

One of the fascinating and perhaps trou-

TABLE 1

Range and Diversity of U.S. Coast Guard Polar Security Cutter Missions

- Conducting maritime law enforcement within the U.S. maritime Arctic (around Alaska) and maritime enforcement of U.S. laws on U.S. flag vessels and American citizens in the Antarctic.
- Responding to high latitude marine incidents, emergencies and potential disasters (from ships or other marine operations such as offshore exploration) and functioning as a command and control platform for all responders.
- Conducting icebreaking in support of the U.S. Antarctic Program, led by the National Science Foundation, with the escort of resupply ships into McMurdo Station in the Ross Sea; icebreaking in support of Alaska's waterways and harbors to facilitate commercial supply access.
- Conducting bathymetric and hydrographic surveys in the U.S. maritime Arctic and remote polar waters where modern surveys (and charts) do not exist; operating as a national hydrographic survey ship in polar waters in support of a potential U.S. extended continental shelf claim under the United Nations Convention on the Law of the Sea (UNCLOS) Article 76.
- Operating as a U.S. naval vessel in support of U.S. Department of Defense and Navy operations in polar waters; conducting joint operations with such forces as the Canadian Coast Guard, Royal Canadian Navy, Royal Danish Navy and other allies; conducting oceanographic research in support of national security.
- Conducting research in the national interest in both polar regions as: (A) a global, mobile observing platform in long transits across the global oceans and in remote polar waters; and (B), serving as an expeditionary research ship for scientific operations in polar waters for federal agency, academic/university and international research; conducting joint research expeditions with foreign icebreaking research ships such as Canada's CCGS *Louis S. St-Laurent*, Germany's *Polarstern* and Sweden's *Oden*.
- Conducting foreign station inspections under the Antarctic Treaty led by State Department teams; and, voyaging around the Southern Continent conducting science and supporting U.S. interests under the Antarctic Treaty.
- Serving as a mobile Coast Guard base with embarked helicopters in polar waters to provide support to a broad range of Coast Guard missions, coastal community support, research, and commercial marine operations.

bling aspects of the current U.S. PSC (aka polar icebreaker) acquisition process is that there have been five major U.S. icebreaker studies conducted since 1984. These are listed in the accompanying sidebar of icebreaker studies from 1984 to 2017. Two were basically interagency studies in 1984 and 1990; two were conducted by the National Academies and released in 2007 and 2017; and one was conducted by the Coast Guard itself (with consultants) and completed in July 2010 (with an additional review in 2017). Although there have been endless studies and debates on this topic for four decades, the bottom line in each of these assessments was that the U.S. required a robust federal icebreaker fleet operated by the Coast Guard. The key requirement is to assure U.S. maritime sovereign presence in the Arctic and Antarctic and to support our many roles as a leading polar nation. More importantly, none of these studies recommended outsourcing our national interests in the polar regions to foreign icebreaker assets; law enforcement, national security responsibilities and federal response can never be passed to a foreign entity, even a close ally. Nor did any of the studies recommend leasing commercial icebreakers to *conduct* federal responsibilities that had been performed by the Coast Guard since the U.S. became an Arctic nation. Several studies did endorse leasing commercial polar ships to support science funded by NSF and other federal agencies.

Two cutters performing a range of missions tied directly to U.S. national interests in both polar regions

A review of this year's current PSC operations provides a glimpse of Coast Guard polar operations, and reinforces the portfolio of missions listed in Table 1. During the winter of 2021, the PSC *Polar Star* operated along the coast of northern Alaska, providing sovereign presence as it conducted joint operations with a variety of Coast Guard and DOD units. This Arctic voyage was made possible because the ship's deployment to the Antarctic for the annual break-in to McMurdo Station had been cancelled due the global pandemic. Significant icebreaking training was conducted, and despite its 45 years of service, *Polar Star* performed admirably in winter conditions of the Bering and Chukchi seas. During the summer of 2021, the PSC *Healy* conducted several high visibility missions in the U.S. maritime Arctic, Canadian Arctic, and Baffin Bay off Greenland's west coast.

After initially conducting helicopter training operations and scientific operations off the west coast of Alaska, *Healy* sailed through Prince of Wales Strait, completing a successful Northwest Passage eastward voyage to Resolute for joint operations with the Canadian Coast Guard and Navy (the Commandant of the Coast Guard and Commissioner of the Canadian Coast Guard joined the ship in Resolute). *Healy* conducted a large oceanographic survey of Baffin Bay led by oceanographers from the Woods Hole Oceanographic Institution. During the voyage, *Healy* acted as a hydrographic survey vessel, operating its multi-beam sonar (led by scientists from the University of New Hampshire) to map previously uncharted regions along the route.

At the writing of this article, *Polar Star* was preparing for its Deep Freeze deployment

MAJOR U.S. POLAR ICEBREAKER STUDIES 1984-2017

- **July 1984:** *United State Polar Icebreaker Requirements Study* (PIRS) – Interagency study; first major icebreaker study in two decades; comprehensive surveys of primary and secondary users; a fleet of four modern icebreakers operated by the U.S. Coast Guard can meet the projected needs for operations in Arctic and Antarctic waters.
- **1990:** PIRS Update and Presidential Report to Congress – Adjusted the key recommendation of PIRS to be a national need for two *Polar*-class ships, one NSF polar research vessel, and one, new (Coast Guard) polar icebreaker with enhanced research capabilities; this resulted in the funding and construction of USCGC *Healy* which was commissioned on 21 August 2000.
- **2007:** National Research Council Report – *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs;* comprehensive and authoritative study reassessing the roles and future needs for Coast Guard polar icebreakers; the Nation needs three multi-mission polar icebreakers (operated by the Coast Guard) and one single-mission research ship (such as the *Palmer* leased by NSF and operated by private industry); recommendation for immediate funding and construction of two polar icebreakers to replace *Polar Star and Polar Sea.*
- **July 2010:** *U.S. Coast Guard High Latitude Study* – passed to Congress in July 2011; a team of outside consultants working for the Coast Guard using operational research modelling concluded that to meet its statutory polar missions the Service would require three heavy and three medium icebreakers; if a requirement for continuous (persistent) polar presence in all regions was determined, more icebreakers would be needed; the bottom line again was the Coast Guard should operate the Nation's polar icebreaker fleet for global operations.
- **July 2017:** National Academies Letter Report – *Acquisition and Operations of Polar Icebreakers: Fulfilling the Nation's Needs;* restated that for 30 years of icebreaker studies the Nation has failed to respond; recommended funding of four polar icebreakers of common design to be operated by the Coast Guard; the Coast Guard should follow an acquisition strategy that includes block buy contracting with a fixed price and incentive fees.
- **October 2017:** U.S. Coast Guard Academy's Center for Arctic Study & Policy: *Addendum to the United States Coast Guard High Latitude Region Mission Analysis;* major, independent review of the High Latitude Study (HLS) that studied the evolving operational and strategic environments; report summarized recent developments in both polar regions providing confidence to the Coast Guard leadership regrading the initial HLS recommendations.

to the Antarctic for break-in to McMurdo for the U.S. Antarctic Program.

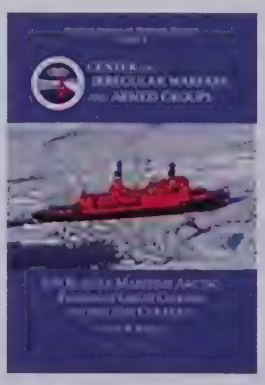
In early 2022, the first steel will be cut for the first replacement PSC being built at VT Halter Marine in Pascagoula, Mississippi. A new era has begun with the Congress authorizing, in November 2020, up to six new PCSs (three what the Coast Guard calls heavy icebreakers and three of more modest size). The vision is that the new cutters will be fully multi-mission capable, and that they will include research capabilities robust enough to conduct world-class science in Arctic and Antarctic waters.

Lawson W. Brigham is a Wilson Center | Polar Institute Global Fellow, a researcher at the University of Alaska Fairbanks, and a Fellow at the U.S. Coast Guard Academy's Center for Arctic Study & Policy. He was a career Coast Guard officer, and commanded four cutters including the icebreaker Polar Sea on Arctic & Antarctic expeditions. During 2004-2009, he was chair of the Arctic Council's Arctic Marine Shipping Assessment. Captain Brigham is a member of the National Academies Polar Research Board and is a member of the Council on Foreign Relations. His research interests have focused on the Russian maritime Arctic, environmental change, polar marine transportation, and polar geopolitics.

U.S. NAVAL WAR COLLEGE CASE STUDY

The Russian Maritime Arctic: Region of Great Change in the 21st Century

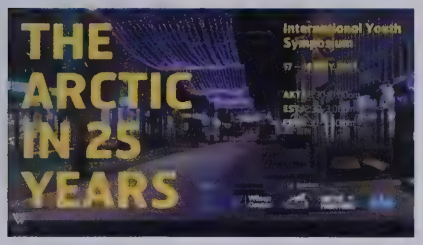
This case study focuses on the evolution and development of the critical maritime region of the Russian Arctic out into the future. It specifically considers what the Russian state may initiate in Arctic economic projects, and what aspects of this region Russia will seek to control, in what will most certainly become one of the vital ocean corridors of the world. The case highlights what factors may constitute the outlines of further development in a region that is not only important today and is emerging as a vital resource area and transport waterway, but also one that could evolve into a zone of competition, or even conflict, during this era of great power rivalry.



The author explores important insights into how Russia may develop its Arctic maritime capabilities and use this region as a springboard to further Russian maritime power, as well as overall economic strength.

Download full text here:
https://digital-commons.usnwc.edu/ciwag-case-studies/19/

CIRCUMPOLAR COLLABORATION: AN ARCTIC YOUTH PERSPECTIVE



From her experiences organizing an international Arctic youth symposium, as well as related volunteer and travel experiences, Michaela Stith observes that solutions to systemic problems such as climate change and racism will not come by way of either rapid or technical fixes. It will take a culture shift to establish deep relationship-building and policy change.

by Michaela Stith
Program Assistant, Polar Institute, the Wilson Center

CROSS-BORDER COLLABORATION

and relationship-building among Arctic youth is an important way to forge a better future in the face of drastic change. With over 80 Indigenous languages spoken and four million people living in the Arctic, there is a great diversity of life experiences and identities across the region. By building relationships across borders, we can imagine innovative solutions to our shared challenges.

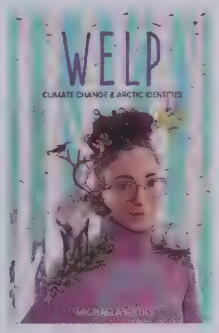
Over two dozen young leaders from all eight Arctic States (Canada, Denmark, Finland, Iceland, Norway, Sweden, the Russian Federation, and the United States) and Indigenous peoples across the Circumpolar North gathered virtually on May 17th and 18th, 2021, for "The Arctic in 25 Years: the First Annual International Youth Symposium." The Wilson Center's Polar Institute hosted the event with Arctic Frontiers, the Arctic Council Permanent Participant Youth (supported by the Indigenous Peoples' Secretariat) and the Arctic Youth Ambassadors to inform potential Arctic policy and research for the next generation. As a 25-year-old Program Assistant at Polar Institute of the Woodrow Wilson International Center for Scholars, it was the first event I had the pleasure of independently planning, organizing and moderating.

The seeds for *The Arctic in 25 Years* initiative were planted back in November 2019, when the six Indigenous organizations recognized as Permanent Participants in the Arctic Council held the first ever Arctic Youth Leaders' Summit. When Indigenous youth from every country in the Arctic stood together onstage in Rovaniemi, Finland/Roavvenjárga, Sápmi and read aloud their joint declaration, it became abundantly clear that Arctic youth have the skills, knowledge, and expertise to contribute to policy in the region. Foremost on the youth's minds, among issues like free, prior, and informed consent and revitalization of Indigenous languages, was climate change.

As an Associate at the Arctic Council Indigenous Peoples' Secretariat (IPS), which had assisted the Saami Council in organizing the event, I was lucky enough to listen in. My work with IPS was made possible by the Hart Leadership Fellows program, which awards Duke University graduates stipends to live and work abroad. Upon recommendation by the Arctic Athabaskan Council, I had volunteered with IPS from July 2018 to May 2019. During that time, I traveled to events like the 2nd Arctic Science Ministerial in Berlin, Germany; the 11th Arctic Council Ministerial Meeting in Rovaniemi, Finland; and the Arctic – Territory of Dialogue meeting in St. Petersburg, Russia. Outside of work, IPS staff introduced me to life in Sápmi by taking snowmobile rides in -15 C weather to reindeer herds outside Guovdegeaidnu in Troms og Finnmark county, Norway and introducing me to the Riddu Riđđu youth program, where I learned how to dance sydis (South Sámi dance).

As a lifelong Alaskan, traveling outside the state was expensive and uncomfortable at times. When I went to study in the Lower 48 of the United States, I learned that many people think the Arctic is devoid of people and filled with polar bears. Therefore, it became important to me to paint an honest portrait of the Arctic and the place I call home. I am a firm believer that a truthful story from the heart is the one people most need to hear. Through intimate interviews, laugh-out-loud stories, and my own observations, my newly released travel memoir, *Welp: Climate Change and Arctic Identities*, explores the effects of climate change, white supremacy, and cultural biases on Indigenous, Black, and dark-skinned identities in the North. It is crucial to allow these stories to guide our collective way forward.

Above all, I've learned from Arctic youth that the solutions to systemic problems like climate change and racism will not come with a quick or technical fix. It will take a culture shift. And the very first step in that shift, before deep relationship-building or policy change, is exposure to new information. To that end, please join me in amplifying Arctic youth perspectives by sharing these QR codes and links:



The Arctic in 25 Years: First Annual International Youth Symposium: https://www.youtube.com/embed/z10yvciuzMA

2019 Arctic Leaders' Summit Declaration

Welp: Climate Change and Arctic Identities (new book).

CONSPIRACY OF CARTOGRAPHERS

Global Melting – The Inland Sea of Greenland

by Jeffrey Linn

DAY 19 of the NACIS 30-day Map Challenge. Theme: *Islands*.

It's a perfect time to debut this map of one of the world's largest islands, set far in the future.

This hidden geography is fascinating. The landforms that emerge from a changing climate, even when horrifying, are amazing to see.

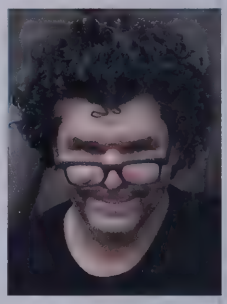
I've been criticized for this one, specifically for not taking into account isostatic rebound, the rising up of land that has been pressed down by the weight of miles of ice. It's a fair criticism, but like all my other sea level rise maps, this is a simplistic model. In addition to not taking the rebound of land mass into account, I always use the 66m sea level rise number. This elevation will always be inaccurate because of local geographies, tidal actions, and gravity. The actual level will vary from place to place; sea level rise is very localized.

But for this model, does it really matter? The disaster to humanity and the world is clear. The complete melting of the ice caps is in the far-distant future. A few meters more or less is irrelevant.

Bottom line: When its ice melts, Greenland's interior will become a vast inland sea…

Projects that unite data, art, and humor

Jeffrey Linn is a Speculative Cartographer. He creates maps of the Earth as it might exist in the future, and imagines new worlds for AAA game developers and speculative fiction.



Jeffrey's expertise in modern cartographic techniques enable his maps to transcend the tropes of fantasy cartography. His knowledge of geography and spatial design, and his appreciation of mythology and history bring realism and depth to his work. He has a passion for collaborative processes, creating places that are informed by the narratives and visions of the world-building team. In turn, his maps inform and inspire the imaginations of game designers and narrative writers.

Jeffrey's work has been featured in the *Washington Post*, *Foreign Policy*, *Grist*, and the *Huffington Post*. It has been praised by Ursula K. Le Guin, and verified by *Snopes*.

Jeffrey holds a BA in Geography from San Francisco State University, and a Master's Degree in Landscape Architecture from the University of Washington.

Conspiracy of Cartographers website

Left to right: Greenland with 66m Sea Level Rise © Jeffrey Linn
Relief location map of Greenland – Equidistant conic projection. Photo by Uwe Dedering

ON THE EDGE

Excerpted from a Discovery+ press release: *National Geographic* teams up again with climber Alex Honnold for an adrenaline-fueled climbing quest – scaling the impossible walls and most dangerous and remote peaks of Greenland – all in the name of science!

BURBANK, Calif. (August, 2021) – Produced by Plimsoll Productions for National Geographic (to air on Discovery+), the three-part original docuseries, "On the Edge with Alex Honnold," will see Honnold embark on a lifelong dream – an epic climbing quest across the remotest and toughest walls and peaks of Greenland, a country on the frontline of the climate crisis.

Honnold, subject of white-knuckled Oscar®-winning documentary, "Free Solo," has always dreamt of exploring Greenland and summiting its most challenging and remote peaks. But this isn't just adventure for adventure's sake – along the way, as he attempts a once-in-a-lifetime climbing challenge that will push his physical limits, Honnold will meet the scientists working on the frontline of climate change and witness the impacts of the rapid melting for himself.

With an overabundance of virgin climbs, impossible walls, world class and deadly, Greenland is considered the world's last great climbing frontier and has also become the crucible of the climate crisis. In 2020, 300 billion tons of Greenland ice disappeared, the biggest annual melt in recorded history. As Honnold explores the impact that has had, he and his team will face intimidating icebergs, dangerous moulins (sinkholes on glaciers), difficult rockfalls and ice storms.

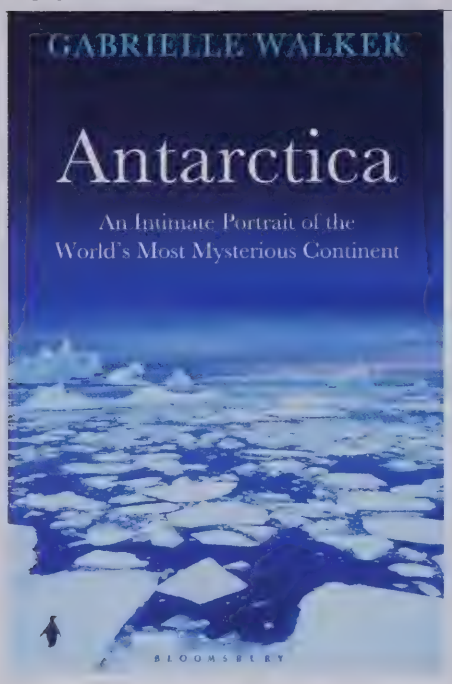
His ultimate test will come from Peak 3342, to-date unclimbed and one of the highest peaks in Greenland. Though there's more exposed rock and less snow and ice, this is uncharted territory, and Honnold will need to draw on all of his experience to reach the top safely.

"I've always wanted to climb in Greenland – it has some of the most remote and epic walls in the world. But it's also being tremendously affected by climate change," said Honnold. "I'm very excited about the opportunity to explore the climbing while also sharing some of the local impacts of climate change with a global audience. Our changing climate is the biggest issue facing humanity, and I hope that this will help inspire people to take action."

Honnold is a professional adventure rock climber whose audacious free solo ascents of America's biggest cliffs have made him one of the most recognized and followed climbers in the world. He is also the founder of the Honnold Foundation, an environmental nonprofit devoted to fighting climate change by promoting solar energy for a more equitable world. A gifted but hard-working athlete, Alex "No Big Deal" Honnold is known as much for his humble, self-effacing attitude as he is for the dizzyingly tall cliffs he has climbed without a rope to protect him if he falls. Honnold has been profiled by "60 Minutes" and *The New York Times*, featured on the cover of *National Geographic*, appeared in international television commercials and starred in numerous adventure films, including the Academy Award-winning documentary feature "Free Solo," released by National Geographic Documentary Films, and the Emmy-nominated "Alone on the Wall." He is also the co-host and co-creator of the chart-topping podcast Climbing Gold.

"I've always wanted to climb in Greenland – it has some of the most remote and epic walls in the world. But it's also being tremendously affected by climate change," said Honnold. "I'm very excited about the opportunity to explore the climbing while also sharing some of the local impacts of climate change with a global audience. Our changing climate is the biggest issue facing humanity, and I hope that this will help inspire people to take action."

Photo credit: ©Alex Honnold © National Geographic



Antarctica: An Intimate Portrait of a Mysterious Continent

by Gabrielle Walker (London: Bloomsbury, 2012; 416 pp, $27)

Reviewed by Jeff Rubin

Science journalist Gabrielle Walker, who earned a PhD in natural sciences from Cambridge University, visited Antarctica five times before she wrote this wide-ranging and highly-engaging portrayal of contemporary Antarctica.

She spent several stints at the South Pole, stayed four months at McMurdo and visited field camps around the continent. She was also the guest of the British, French, Italian and New Zealand governments in Antarctica, and visited the Peninsula aboard a tourist vessel.

As she criss-crossed Antarctica, Walker interviewed and observed many workers and scientists of varied disciplines, original research for the articles she wrote for *New Scientist* and other magazines.

Interspersed throughout the narrative of these peregrinations are short retellings of key moments in Antarctic history — the *Endurance* saga, for example — but Walker's at her best when interrogating present-day Antarcticans not only about their work but also about their motivations and their feelings for The Ice itself.

At McMurdo, she met marine biologist Sam Bowser, who studies foraminifera, one-celled sea creatures with particularly gruesome eating habits. She visited the "Penguin Ranch" a few hours' drive away on the sea ice, where Paul Ponganis and his colleagues monitor emperor penguins using a solitary breathing hole in a section of ice surrounded by a temporary fence to ensure that the birds return to the same place whenever they resurface.

She spoke with Ralph Harvey about ANSMET, the Antarctic Search for Meteorites, and made a 60-minute foray with veteran meteorite hunter John Schutt onto the Allan Hills icefield, where he bagged a dark-chocolate ordinary chondrite.

In the Dry Valleys, Walker spent time with Jim Head, who studies their parallels with Mars. She interviewed Rae Spain, camp manager at Lake Hoare; Chris McKay, who studies cyanobacteria that grow inside rocks; and biologist Peter Doran, who probes Antarctic lakes.

At the French Dumont d'Urville station, among those who work she followed were penguin researcher Caroline Gilbert, seabird scientist Olivier Chastel, whose favorite research subject is snow petrels, and Thierry Raclot, who scrutinizes the mating strategies of Adélie penguins.

At 90° South, she was taken aback by the rude 'greeting' offered to her by Harvard astronomer Tony Stark, who blurted: "I hope you're going to do a good job, because you're taking the space of someone who could be critical to the scientific enterprise." Fortunately Walker resisted the urge to respond in kind, then neatly skewered his arrogance and disingenuity.

At Pole she also met self-described "telescope nannies" Robert Schwarz and Steffen Richter, who monitor astronomical instruments through the cold, dark winter. She even gained philosophical insights on coping with "burnt toast" during an after-hours chat with legendary five-time consecutive overwinterer Jake Speed.

While visiting Concordia, the joint French-Italian station on the East Antarctic Ice Sheet, she observed the EPICA (European Project for Ice Coring in Antarctica) team in their final weeks of the decade-long task of drilling through the ice sheet for clues to past climate. This section is particularly rich in detail.

Walker even managed the particularly difficult feat of reaching the deep-field camp at Upstream D on the West Antarctic Ice Sheet. There, Barclay Kamb and his colleagues were trying to decipher why the massive glaciers in that region are moving faster than almost any other ice on earth.

Walker's entire book is well-written and thoroughly engrossing. She achieves a crescendo of brilliant synthesis and clarity, strongly bolstered by supporting references, in the final section on the hydrology of Antarctica's subglacial lakes and George Denton's work on ancient water courses in the Dry Valleys. It is extremely enjoyable reading.

Along the way, we pick up stray but wonderful facts that may be unknown to even the most well-versed Antarctican. The skin temperature of overwintering male emperor penguins sheltering eggs just above their feet inside a huddle on the sea ice, for instance, can reach 96.8° F — not only the optimum temperature for incubating the eggs, but often 150° F warmer than the ambient air.

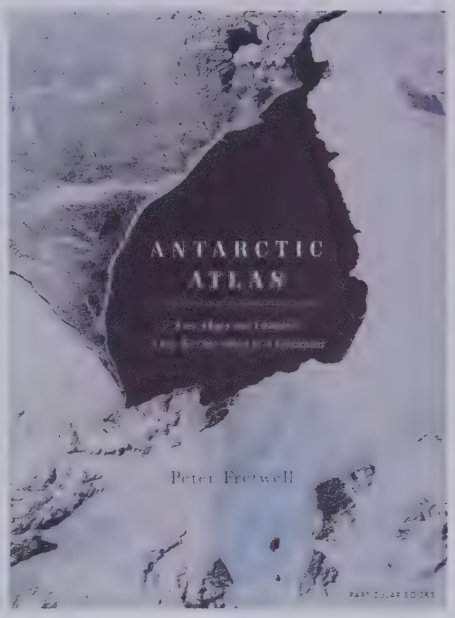
A few quibbles: Walker uncritically repeats the apocryphal tale about a Soviet scientist killing a colleague at an Antarctic station over a game of chess — with no further details. Date? Location? Source? There aren't any. It never happened.

She also botches the quote inscribed on the memorial cross atop Observation Hill set up by Capt. Scott's surviving colleagues. I winced when I read, "To search, to seek, to strive and not to yield," because it is so horribly, jarringly, downright George W. Bush unpoetic, whereas Tennyson's final line of "Ulysses" is sublime: "To strive, to seek, to find, and not to yield."

Antarctic Atlas: New Maps and Graphics That Tell the Story of a Continent

by Peter Fretwell (London: Penguin, 2021; 208 pp, £35)

Reviewed by Jeff Rubin



Fretwell, a cartographer and scientist at the British Antarctic Survey, has created a fascinating and remarkably handsome portrait of the White Continent, highlighting the unique power of presenting information in graphic form.

Seventy maps and dozens of diagrams, all in full color, are classed into nine chapters: Geography, Ice, Land, Atmosphere, Sea, Wildlife, People, Exploration and finally, but certainly not least, Future.

First of all: many of these images are just plain beautiful.

To single out just two examples: Map #23 "Majestic Mountains," a blue-tinted double-page spread shows the Sentinel Mountains, home of Vinson Massif, Antarctica's highest peak, and its four runners-up. Maybe even more impressive is Map #24 "The wolf at the end of the world," showing the peaks in Dronning Maud Land's Drygalski Mountains known as the Fenriskjeften (Wolf's Jaw) and the fanglike shadows they cast across the ice sheet.

Others impart important information in striking ways. Map #35 "The engine of the ocean," is no visual stunner, but combined with the accompanying text its description of thermohaline circulation is excellent and readily understood.

Map #38 "Earth's lungs," explains how the world's oceans have taken up heat and CO_2 in nearly-unbelievable quantities since the beginning of the Industrial Revolution two centuries ago. The Southern Ocean alone is calculated to have absorbed 43% of the extra carbon we've put into the atmosphere — and fully three-quarters of all of the extra heat caused by the greenhouse effect.

Because Fretwell pioneered the use of satellite imagery to find and monitor polar wildlife, a project that led him to discover almost half of the world's emperor penguin colonies, it's especially poignant that Map #40 documents the decline of this magnificent bird. The numbers of this sea-ice resident will plummet to just 30% of today's population in the next 80 years, with 34 out of 53 colonies going extinct as their empire melts beneath their feet.

In some cases, the sheer amount of data depicted is both mind-boggling and visually-dazzling. Map #42 "International seal travels" collates GPS positions from nine different countries that use data loggers to track seals. Map #43 "The blood-red sea" pinpoints the location where each of the 1,600,000 whales were killed in the Southern Ocean between 1915 and 1984.

The final two maps are especially interesting, for they name features that do not exist yet. Map #69 draws the continent circa 2500, using the most up-to-date models available to illustrate changes caused by a warming climate that will raise sea levels by 10 meters and melt 10% of Antarctica's ice. The Ronne Ice Shelf disappears completely, more than 70% of the West Antarctic Ice Sheet melts into a new "West Antarctic Sea," and a new break, "Evans Channel," separates the Antarctic Peninsula from the rest of the continent.

By the year 10,000 (Map #70), if we burn all the known coal, oil and gas, Antarctica will be completely iceless. Sea levels will rise 66 meters, making West Antarctica and the Peninsula an archipelago surrounding the larger mass of East Antarctica, parts of which will rise by up to a kilometer once the enormous burden of overlying ice is gone.

Two additional features of the book deserve special mention. Fifteen gorgeous full-page satellite images — most, but not all, showing parts of Antarctica or the peri-Antarctic islands — are so striking that they rival much fine art. And Lisa Fretwell's small illustrations sprinkled throughout the book are wonderful.

Just three important mistakes mar the text; they require correcting lest they be repeated elsewhere. On p175, the author writes "...at one stage shots were exchanged between Chilean and Argentine troops on the South Shetland Islands." Thankfully this is untrue! In fact, the incident was one-sided; involved Argentine and British people; and took place in 1952 at Hope Bay on the Antarctic Peninsula. British expeditioners arriving to re-establish a base that had earlier burned down were greeted with a decidedly unfriendly welcome from their Argentine neighbors, who fired a machine gun over their heads. No one, mercifully, was hurt.

On November 28, 1979, all 257 people (not 237, as stated on p180) aboard Air New Zealand Flight 901 were killed when their DC-10 flew into Mt Erebus. This tragedy, however, was not Antarctica's worst loss of life. In September 1819 the man-of-war *San Telmo*, flagship of a Spanish naval squadron bound for Lima, struck severe weather while crossing the Drake Passage and lost her rudder and topmasts near Cape Shirreff on Livingston Island. Although taken in tow by an accompanying ship, the hawsers parted and *San Telmo* was lost – along with 644 sailors, soldiers and marines. At the June 2021 Antarctic Treaty Consultative Meeting, Spain proposed that the San Telmo wreck, whenever it is located, be designated a protected Historic Site.

Finally, the claim (on p60) that "it has not rained [in the Dry Valleys] for over three million years" — though often repeated elsewhere — is incorrect. It has indeed

rained in the Dry Valleys very recently; several times, in fact, including in 1959, 1968, 1970 and 1974.

A few minor errata are worth noting simply in case this terrific book is published in another edition, as it deserves. The chart on p49 misspells Borchgrevink and Amundsen, p91's satellite image mislabels Heard Island as "McDonald Island" and the clouds at the island's eastern end obscure its true topography, while the map of Mac Town (McMurdo station) on p136 lists "Wiley Field Road" instead of "Willy Field Road." The map on p142-143 mistakenly labels Livingston Island as "Livingstone" and Operation High Jump's ship was USS *Philippine Sea*, not 'Philippian Sea' (p175).

ADDITIONAL READING

Skiing Into the Bright Open My Solo Journey to the South Pole

Author: Liv Arnesen
Translated by Roland Huntford, 2021

Foreword by Ann Bancroft

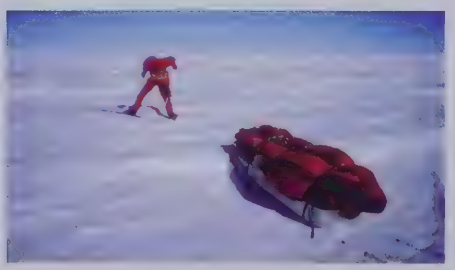
The first woman to ski solo to the South Pole tells the story of what it took to get there.

At home in Norway, it is 8:00pm on Christmas Eve, while at Amundsen–Scott Base, it is already early morning on Christmas Day when after skiing solo for 745 miles in only 50 days, Liv Arnesen finally arrives. She had been dreaming of the South Pole for most of her forty-one years, and now, even in her joy at having reached her goal in December 1994, she has to ask herself: "What took you so long?" In *Skiing into the Bright Open*, Arnesen describes the exhausting yet exhilarating experience of being the first known woman to ski unsupported to the South Pole. She also answers her own question, framing the account of her historic expedition within the context of her longtime struggle to find the freedom and confidence to follow her dreams into uncharted territory.

From her childhood in Norway to the seasons she spent working as a guide on Svalbard, the Norwegian archipelago in the Arctic Ocean, Arnesen courted the cold. Her memoir reflects the knowledge and passion for Arctic and Antarctic exploration that grew with her adventures in the wintry reaches of Norway and beyond. Tracing her path from the heroic stories

of explorers like Fridtjof Nansen and Ernest Shackleton to her own crossing of the Greenland Ice Cap in 1992, Arnesen credits those who preceded her for these inspiring feats. She makes a point to also describe the obstacles, particularly conventional norms and outright prejudice, which presented additional challenges she had to overcome as she endeavored to find the support and sponsorships traditionally granted to men in her field.

A tale of solitary adventure in the bleak and beautiful bone-chilling cold of Antarctica, Skiing into the Bright Open tells a story of gritty determination, thrilling achievement, and perseverance in the face of near despair and daunting odds; it is, ultimately, an object lesson in the power of a dream if one is willing to pursue it to the ends of the Earth.



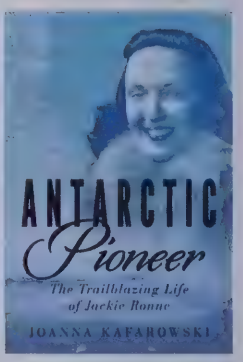
TEDxOslo talk: Liv Arnesen – The Power of Dreams

(AVAILABLE FOR PRE-ORDER)

Antarctic Pioneer: The Trailblazing Life of Jackie Ronne

by Joanna Kafarowski
Dundurn Press
May, 2022

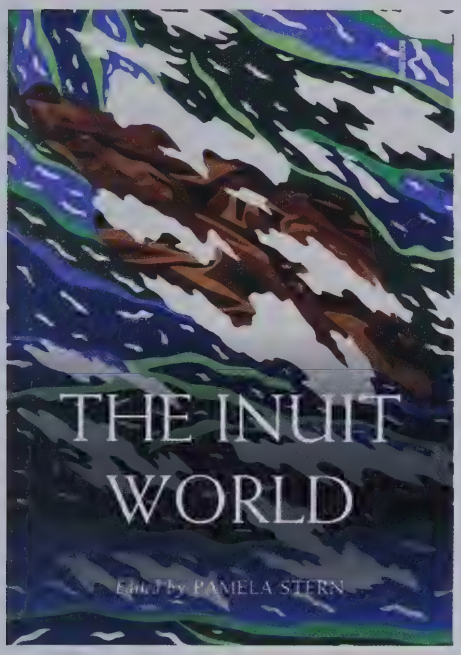
Jackie Ronne reclaims her rightful place in polar history as the first American woman in Antarctica.



Jackie was an ordinary American girl whose life changed after a blind date with rugged Antarctic explorer Finn Ronne. After marrying, they began planning the 1946–48 Ronne Antarctic Research Expedition. Her participation was not welcomed by the expedition team of red-blooded males eager to prove themselves in the hostile environment.

On March 12, 1947, Jackie Ronne became the first American woman in Antarctica, and, months later, one of the first women to overwinter there.

The Ronne Antarctic Research Expedition secured its place in Antarctic history, but its scientific contributions have been overshadowed by conflict and the dangerous accidents that occurred. Jackie dedicated her life to Antarctica through promoting the achievements of the expedition and her husband's legacy. She was also a pioneer in polar tourism and an early supporter of the Antarctic Treaty. In doing so, she helped shape the narrative of twentieth-century Antarctic exploration.



The Inuit World

Edited by Pamela Stern
Routledge
November, 2021

The Inuit World is a robust and holistic reference source to contemporary Inuit life from the intimate world of the household to the global stage. Organized around the themes of physical worlds, moral, spiritual and intellectual worlds, intimate and everyday worlds, and social and political worlds, this book includes ethnographically rich contributions from a range of scholars, including Inuit and other Indigenous authors. The book considers regional, social, and cultural differences as well as the shared histories and common cultural practices that allow us to recognize Inuit as a single, distinct Indigenous people. The chapters demonstrate both the historical continuity of Inuit culture and the dynamic ways that Inuit people have responded to changing social, environmental, political, and economic conditions. Chapter topics include ancestral landscapes, tourism and archaeology, resource extraction and climate change, environmental activism, and women's leadership.

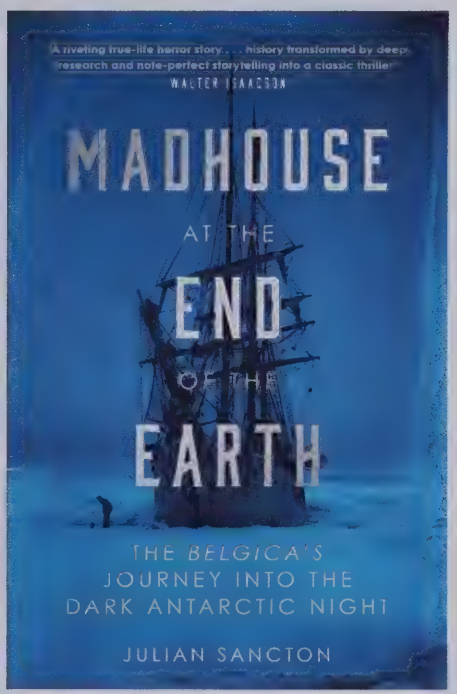
This book is an invaluable resource for students and researchers in anthropology, Indigenous studies, and Arctic studies and those in related fields including geography, history, sociology, political science, and education.

PRINT & AUDIO BOOK

Madhouse at the End of the Earth: The *Belgica's* Journey into the Dark Antarctic Night

By Julian Sancton
May, 2021

In August 1897, the young Belgian commandant Adrien de Gerlache set sail for a three-year expedition aboard the good ship *Belgica* with dreams of glory. His destination was the uncharted end of the earth: the icy continent of Antarctica.



But de Gerlache's plans to be first to the magnetic South Pole would swiftly go awry. After a series of costly setbacks, the commandant faced two bad options: turn back in defeat and spare his men the devastating Antarctic winter, or recklessly chase fame by sailing deeper into the freezing waters. De Gerlache sailed on, and soon the *Belgica* was stuck fast in the icy hold of the Bellingshausen Sea. When the sun set on the magnificent polar landscape one last time, the ship's occupants were condemned to months of endless night. In the darkness, plagued by a mysterious illness and besieged by monotony, they descended into madness.

In *Madhouse at the End of the Earth*, Julian Sancton unfolds an epic story of adventure and horror for the ages. As the *Belgica's* men teetered on the brink, de Gerlache relied increasingly on two young officers whose friendship had blossomed in captivity: the expedition's lone American, Dr. Frederick Cook—half genius, half con man—whose later infamy would overshadow his brilliance on the *Belgica*; and the ship's first mate, soon-to-be legendary Roald Amundsen, even in his youth the storybook picture of a sailor. Together, they would plan a last-ditch, nearly certain-to-fail escape from the ice—one that would either etch their names in history or doom them to a terrible fate at the ocean's bottom.

Drawing on the diaries and journals of the *Belgica*'s crew and with exclusive access to the ship's logbook, Sancton brings novelistic flair to a story of human extremes, one so remarkable that even today NASA studies it for research on isolation for future missions to Mars. Equal parts maritime thriller and gothic horror, *Madhouse at the End of the Earth* is an unforgettable journey into the deep.

Listen to an audio sample from "Madhouse at the End of the Earth."

DISCOVERY OF A NEW MOSS SPECIES BY THE INDIAN ANTARCTIC MISSION

Close-up view of Antarctic Bryum bharatiense moss. Photo: Felix Bast

An Ode to Ice and Ambition

by Felix Bast

IT WAS DURING THE AUSTRAL SUMMER OF 2017, that I stumbled upon a moss turf while wandering around the islands of Larsemann Hills, East Antarctica. The soft, dark green turf around the rocky oases instantaneously captured my attention as I wondered how moss could live on this gelid continent without any source of nitrogen and phosphorus. Moreover, how was moss – a photosynthetic organism – able to survive the long period of austral winter during which the continent slips into a prolonged state of pitch darkness?

I was an expedition scientist of the Indian Antarctic Mission. The moss specimen had been collected from the interiors of Fisher Island and MacLeod Island, where the stench of rotten fish prevails, and copious amounts of penguin poop can be seen everywhere. For the uninformed, penguins are piscivorous animals; they eat fish and krill almost exclusively. My PhD student, Wahid Ul Rahman, collaborator Dr. Kriti Gupta, and I would spend the next four years studying intricacies of its morphology and DNA sequences. The paper describing the discovery of this new Antarctic moss species, *Bryum bharatiense sp. nov.* (*Bryaceae*), was published in September, 2021.

Personal commentary on taxonomy

The branch of science concerned with classification, especially of organisms, is called taxonomy. An increasing trend over the last few decades is that taxonomists name new species after people. Let us examine the motives and ramifications.

The main motive for naming biological species after human beings is to acknowledge the work done by another scientist who has substantially contributed to the study of the same or related species. Second, it can be a form of *quid pro quo* - an understanding between colleagues that "I will name my next species after you, and you name yours after me," analogous to citation reciprocity agreements. Third, it is at times used as a form of appeasement, for example, to one's PhD supervisors, employers, parents or spouses. Fourth, it can act as

Our discovery had several impacts. First, it added yet more proof to the already documented battery of evidence of the "greenification" of Antarctica due to global warming. As the continent grows warmer, the habitat becomes conducive for the growth and proliferation of several temperate and subpolar species. Second, survival strategies of living organisms in these extreme environments provide clues on the origin of species here on Earth, and guide us in our search for extraterrestrial life within the discipline of astrobiology.

a reward to funders, or even be a form of bribery. "I will name my next species after you in return for hard cash!"

In my view, naming species after persons is a bad idea for several reasons. First and foremost, doing so conveys an anthropocentric worldview that we humans occupy a privileged position among other living beings. Second, people's legacies change over time; it might be perfectly reasonable to name a species after a prominent scientist of today until a dark secret of his/her personal life emerges, he/she is convicted for a sexual offence, for instance. Existing rules of taxonomic codes do not allow the renaming of already named species in the name of ethical or political correctness. The species epithet is a sure way for the offender to have his/her name immortalized.

By recognizing these issues in the context of naming species after people, banning this practice *in toto* is the need of the hour for taxonomic organizations worldwide. For the same reasons, the naming of places and geographical features after living persons should also be discouraged.

The significance of *Bryum bharatiense*

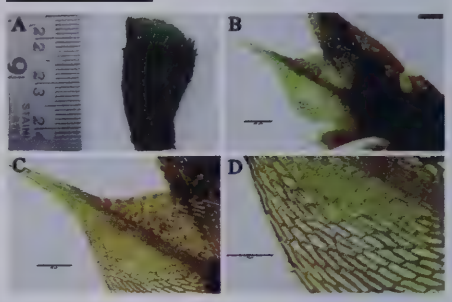
Taking the aforementioned principles into account, we named the new Antarctic moss species *Bryum bharatiense*. The three reasons for our decision are: it was collected in a location proximal to Bharati – the Indian Antarctic base where I was based at the time of the collection, Bharat being the Sanskrit word of India, and Bharati being the Goddess of learning, also referred to as Saraswati. By naming it after the Goddess of learning, we were subtly highlighting the significance of a lifelong pursuit of knowledge.

Larger colony of clumped growth of Antarctic Bryum bharatiense moss. Photo: Felix Bast

ABOVE: Research stations in Larsemann Hills oasis (2012) – Council of Managers of National Antarctic Programs (COMNAP); Bharati Station added by Szczureq (CC-3.0). BELOW: Dr. Felix Bast.

Our discovery had several impacts. First, it added yet more proof to the already documented battery of evidence of the "greenification" of Antarctica due to global warming. As the continent grows warmer, the habitat becomes conducive for the growth and proliferation of several temperate and subpolar species. Second, survival strategies of living organisms in these extreme environments provide clues on the origin of species here on Earth, and guide us in our search for extraterrestrial life within the discipline of astrobiology. Antarctica shares several similarities with celestial bodies, which are current favourites of astrobiologists, including Mars, Enceladus, Titan, Ganymede, and Europa. It is to be noted that the mosses in Antarctica have a heavier isotope of nitrogen (N-15), which is a signature of animal origin. Animals usually excrete the lighter isotope (N-14), leading to the sequentially increased accumulation of N-15 as the trophic levels increase. Top predators like seabirds, including penguins, have very high levels of N-15. Therefore, the corollary is that Antarctic moss species, including this new one, obtain their nitrogen from penguin guano. Third, this is the first plant species discovery in the 40 years of the Indian Antarctic Mission that began in 1981.

ABOVE: Geological Map caption: Geology of the Larsemann Hills, Map 13379 Published jointly by the Australian Antarctic Division and Geoscience Australia (CC-4.0)
BELOW: Bryum bharatiense *sp. nov. found on Larsemann Hills: A, Colony of plants; B, Leaf apex at 4×; C, Leaf with coasta at 20×; D, Laminal cells of the leaf at 40×.*



Dr. Felix Bast is an Associate Professor of Botany at the Central University of Punjab, India. He has discovered seven new species of plants, including the Antarctic *Bryum bharatiense* moss. He is also an alumnus of Friday Harbor Laboratories, University of Washington, WA.

Full paper: Morphophylogenetic Assessment of a New Moss Species Bryum bharatiense sp. nov. (Bryaceae) *from Larsemann Hills, Eastern Antarctica – Felix Bast et al.*

THE SNOWFLAKE MYSTERY

Dr. Ken Libbrecht shows us how to grow designer snowflakes. The world expert on snowflakes, he designs custom snowflakes and was the snowflake consultant for the movie *Frozen*. His snowflake photos appear on postage stamps all over the world.

ANTARCTICA ECLIPSED

On December 4, 2021, a handful of people in Antarctica were treated to clear views of a total solar eclipse. It reached totality at 07:44 UTC and lasted just under 2 minutes, darkening the Antarctic summer skies at a time when the Sun stays above the horizon for several months. In this view, the Moon's shadow can be seen falling on the continent. The next total solar eclipse will occur in December 2039.

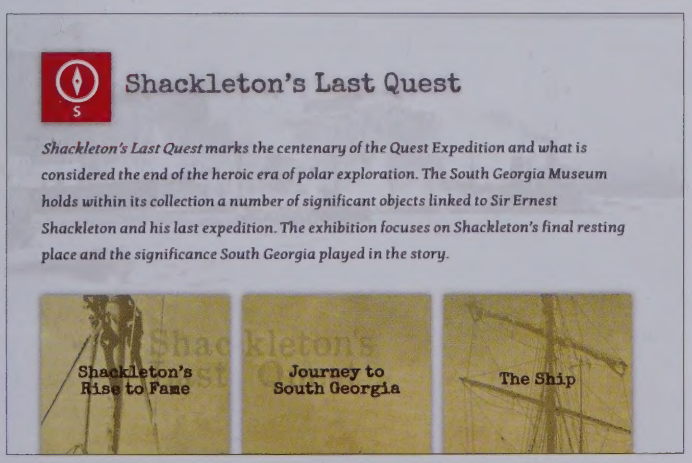
Photo courtesy of NASA Earth Observatory.

MUSEUMS IN THE EXTREME – WEBINAR

Four experts in polar heritage and conservation from the UK Antarctic Heritage Trust (UKAHT) and the South Georgia Heritage Trust (SGHT) share their insights and experiences in caring for this remote heritage at the bottom of the world.

Museums In The Extreme – Webinar

SHACKLETON'S LAST QUEST EXHIBITION AT THE SOUTH GEORGIA MUSEUM


Shackleton's Last Quest
Shackleton's Last Quest marks the centenary of the Quest Expedition and what is considered the end of the heroic era of polar exploration. The South Georgia Museum holds within its collection a number of significant objects linked to Sir Ernest Shackleton and his last expedition. The exhibition focuses on Shackleton's final resting place and the significance South Georgia played in the story.
Shackleton's Rise to Fame
Journey to South Georgia
The Ship

Shackleton's Last Quest marks the centenary of the Quest Expedition and what is considered the end of the heroic era of polar exploration.

THE LAST SHAMAN

(from *Goodbye, Ice – Arctic Poems* by Lawrence Millman)
Angmagssalik, East Greenland

Bedridden he is
this bundle of age
who once could fly
fly high in the sky
just by flexing his index fingers

Songless he is,
this man of songs,
who once could chant away
storms and wild winds
with the guttural of his voice

And full of sickness he is,
this ancient healer,
who once could cure anything
from festering wounds
to possession by evil spirits

Now there's nobody left
to cure him
Flying is easy,
he seems to say,
it's the not flying that's hard

bergie bits

For the not yet ready for prime time polar explorers and scientists to be

MIGRANTS

An award-winning Oscar-eligible CG animated short film.
NOTE: Best for children 10+ of age

A STUNNING WORK of both social commentary and technical dexterity, "Migrants" explores the heartbreaking aftermath of a climate disaster. The animation, which is an impressive collaboration between fifth-year animations students Zoé Devise, Hugo Caby, Antoine Dupriez, Aubin Kubiak, and Lucas Lermytte, who are currently enrolled at the French Pôle 3D school, centers on a simple story: a mother polar bear and her cub fleeing their Arctic habitat as styrofoam icebergs crumble into the water and their once-frozen home becomes unlivable. As they encounter insensitive brown bears in a lush, green climate, the duo struggles to survive.

Quote from a 3DVF interview with the directors:

"We knew we wanted to make a short film about society and current issues. In 2018, there was a controversy about the "Aquarius" boat, which had rescued migrants in the Mediterranean Sea, but no country wanted to allow the boat to land at its ports. We were touched by this, and we were inspired by this event as the subject for our movie. So, we made a story about the issue of migration, but with the global warming theme layered on top of it, and with polar bears as our main characters, as they are one of the species most affected by climate change."

Scan QR code or visit the film URL: https://vimeo.com/647452678

"Hang On!" Clothesline Polar Bear

Concept design and photo by Helga Stentzel

The polar bear used to be at the top of the Arctic food chain, but now, even she has a predator–climate change.

To order a print of the image, scan the QR code. 100 trees will be planted for every print sold.

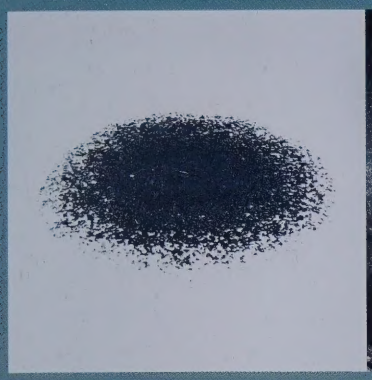
Who says belugas don't dance?

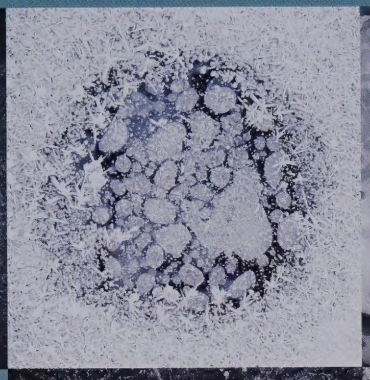
Juno does a wiggle dance along to saxophone music "Jingle Bell Rock" at the Mystic Aquarium in CT.

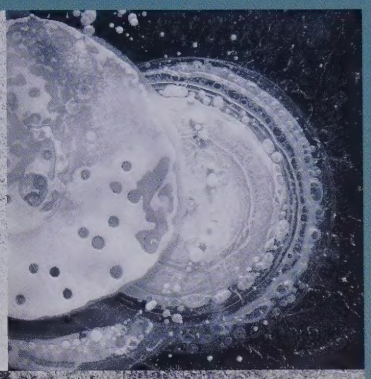
The great baby musk ox chase!

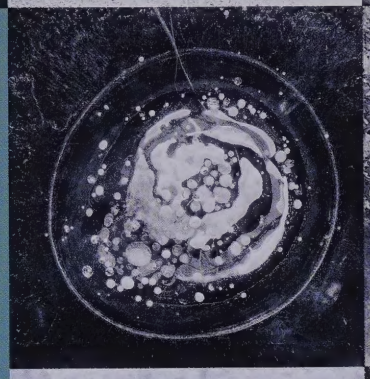
Muskox calves finding their running legs at the Musk Ox Farm in Palmer, Alaska.

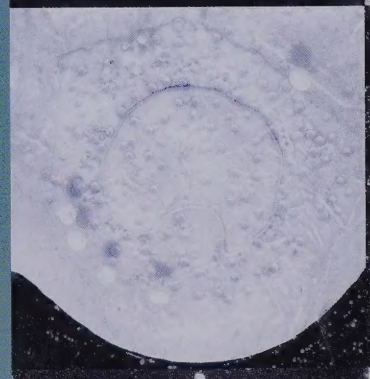
The great baby musk ox chase!

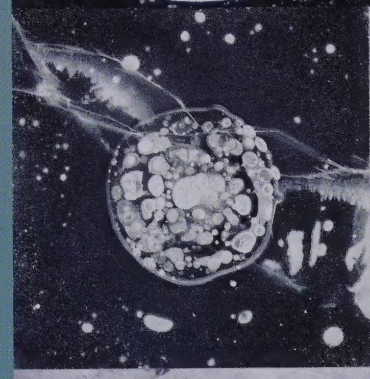


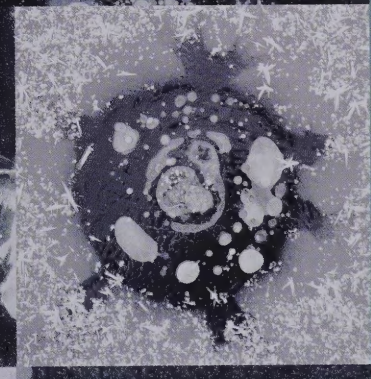


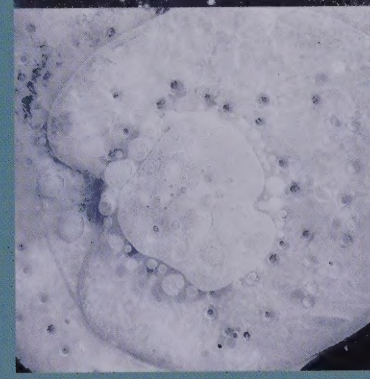












Originally from Japan, **Ryota Kaji Kajita** completed his MFA degree in photography at the University of Alaska Fairbanks, worked at the University of Alaska Museum of the North as a collection photographer, and taught at the Joshibi University of Art and Design in Japan.

His photographs have been exhibited in the Japan Professional Photographers Society Exhibition, Alaska's Rarefied Light, the Aesthetica Art Prize, and the Geo-Cosmos Content Contest of The National Museum of Emerging Science and Innovation among others.

Ryota's photography series of "Ice Formations" is featured in the magazine *Photo Technique* (November/December 2012), WIRED.com (August 2015), *National Geographic Magazine* (March 2020) and is represented by Susan Spiritus Gallery in Newport Beach, California and Fotofilmic in Vancouver, Canada.

Kajita's video documentary "Losing Ground" about Shishmaref Island's severe erosion due to climate change earned the Cinema Committee Choice Award at the Fairbanks Film Festival (2007), and was broadcast on the Alaska Shorts Program of Alaska One television (2012).

He has traveled to more than 50 remote Alaska villages by a two-seat, light aircraft and snowmobile for scientific research.

Ryota Kaji Kajita website

Losing Ground video

Back cover: Back view of "Man Holding Bird," by John Kurok, Leo Napayok